No. A-283

Woolly Bounce

Instructional Computing Courseware
for **Apple® II** Series Computers

A product from the
Science Inquiry Collection

How to use your MECC binder cover inserts

Tear cover on perforated lines. Place half-page title section in the clear vinyl pocket (A) on the front of the binder. Insert finger-sized title in the clear plastic pocket on the spine (B).

Woolly Bounce

No. A-283
For Apple® II Series Computers
K - Grade 2

Explore how a ball's "bounce characteristics" change, depending upon such variables as the type of ball used, the height from which it's dropped, and the kind of surface on which it's dropped.

A product from the
Science Inquiry Collection

Woolly Bounce

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Woolly Bounce

Instructional Computing Courseware
for **Apple® II** Series Computers

A product from the
Science Inquiry Collection

This manual is compatible

with

the ***Woolly Bounce*** disk

Version 1.x

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6160 Summit Drive North
Minneapolis, Minnesota 55430-4003

ISBN 0-7929-0171-1

April 1991

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Library of Congress Cataloging-in-Publication Data

Woolly bounce [computer file]. — Version 1.0.

1 computer disk : 3 1/2 in. + 1 manual. — (Science inquiry collection)

System requirements: Apple II series computers; 128K RAM; BASIC; 1 disk drive; monochrome or color monitor.

Title from title screen.

Edition statement from disk label.

Copy-protected.

Audience: K - Grade 2.

Issued also on 5 1/4 in. computer disk.

Summary: A discovery-learning simulation in physical science in which students explore how balls with different physical characteristics behave differently when dropped. Students, depending on their age and ability, have access to three levels of difficulty in the Explore program; as mastery increases, they may proceed to the Challenge program.

"A-283"— Disk label.

1. Science—Experiments—Juvenile software. 2. Learning by discovery—Juvenile software. I. Minnesota Educational Computing Corporation. II. Series.

LB1532 1991 372.3 91-7230

ISBN 0-7929-0171-1

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AN OVERVIEW OF MECC'S *SCIENCE INQUIRY COLLECTION*

MECC's *Science Inquiry Collection* is a set of software packages specially designed for elementary and junior high school students. Each package covers a specialized topic in the physical, earth, or life science curriculum areas. All of the packages emphasize science inquiry skills appropriate to the skill level of the student and contain accurate scientific content that is found in the school science curriculum. These products incorporate several features that promote student achievement in elementary science, such as:

- instructional objectives that are directly correlated to the objectives addressed in popular science textbooks;
- scientific content that is accurate and important for children to learn;
- thinking processes that are appropriate to the developmental level of the children;
- motivational presentations that stimulate student interest;
- flexible material that can be used in a variety of educational environments; and
- instructional approaches that promote active student involvement and investigative learning.

All instructional materials are most powerful when they are used in conjunction with other educational experiences rather than when they are used in strict isolation. These products are specifically designed to support and complement actual hands-on experimentation in the classroom. The programs encourage children to become active participants in the learning process, beyond computer-based learning, in the following ways:

- the programs provide children with an open and creative environment in which they may develop and apply their problem-solving techniques;
- children can compare and explore the various techniques and thereby strengthen their ability to apply appropriate problem-solving approaches; and
- each package presents instructional material and learning experiences that can readily be transferred to concrete, hands-on classroom activities.

Angry Ball

AN OVERVIEW OF MECC'S *SCIENCE INQUIRY COLLECTION* (continued)

Products currently included in the *Science Inquiry Collection* are briefly described below.

	Grade Levels	Topic
Physical Science		
* **Miner's Cave**	3-6, Jr. High	Simple Machines
* **Mystery Matter**	3-6, Jr. High	Properties of Matter
Mystery Objects	2-4	Properties of Objects
Paper Plane Pilot	3-6, Jr. High	Force and Motion
* **Wood Car Rally**	3-6, Jr. High	Force and Motion
Woolly Bounce	K-2	Force and Motion
Life Science		
* **Backyard Birds**	3-6, Jr. High	Bird Identification
Cavity Busters	3-6, Jr. High	Population Changes
Cleanwater Detectives	3-6, Jr. High	Water Pollution
* **Invisible Bugs**	3-6, Jr. High	Genetics
* **Lunar Greenhouse**	3-6, Jr. High	Plant Growth
* **Weeds to Trees**	3-6, Jr. High	Plant Succession
Earth Science		
* **Five-Star Forecast**	3-6, Jr. High	Weather Forecasting
* **Fossil Hunter**	3-6, Jr. High	Fossil Identification
Murphy's Minerals	3-6, Jr. High	Mineral Identification
Sun and Seasons	3-6, Jr. High	Seasonal Changes

* Award-winners

Sad Ball

INTRODUCTION

Woolly Bounce is a discovery-learning simulation for children in kindergarten through second grade. The programs capitalize on the children's natural curiosity and encourage them to use their curiosity while developing appropriate scientific inquiry skills and/or thinking skills. Like all products in the *Science Inquiry Collection*, ***Woolly Bounce*** features a strong process orientation while presenting material that is firmly anchored in the elementary science curriculum.

In ***Woolly Bounce,*** children are challenged to discover the factors that might influence the bouncing behavior of a set of balls. They observe the height the ball bounces on its first bounce and the number of times the ball bounces before coming to rest.

They can investigate up to 15 different kinds of balls, drop the ball from various heights, and select from two kinds of bouncing surfaces. As children carefully observe, record, and compare the bouncing characteristics, they will discover that each of the three factors influence the ball's behavior. The information collected will then enable children to draw conclusions and make predictions about the balls and their bouncing characteristics.

It is assumed that the children will receive both preparation for and guidance while using these programs. Science terminology related to both physical concepts and inquiry methods are not used in these programs. Memorizing terminology and definitions is not essential for success. The product is designed to emphasize conceptual understanding of both the science concepts and inquiry methods, which, hopefully, will lead to or follow from student-centered classroom investigations on the same or similar topics.

Physical-science concepts addressed by or related to ***Woolly Bounce*** include:

Social Learning

- Names of balls.
- Units 1-10 or 1-20 in sequence.
- Inquiry skills.
- Reading collected data.
- Recording collected data.
- Communication skills.
- Language skills.

Physical Learning

- Balls fall from an opened hand.
- Dropped balls bounce.
- The first bounce is the highest.
- Balls may bounce a number of times before coming to rest.

Logico-mathematical relationships

- The kind of ball influences the height of the first bounce and the number of bounces.
- The height of the drop influences the height of the first bounce and the number of bounces.
- The kind of surface influences the height of the first bounce and the number of bounces.
- Balls may be classified by their physical or behavioral characteristics.

Science inquiry skills developed by ***Woolly Bounce*** include:

- observing;
- communicating;
- comparing;
- organizing;
- relating;
- inferring;
- estimating.

INTRODUCTION (continued)

Both formal and informal investigations play an important role in a child's development. Very often adults have very negative attitudes about children "playing in school when they should be learning." The implication is that one cannot learn while playing.

Researchers have found, however, that about 50% of a person's intellectual capacity has developed by the age of four and 80% by the age of eight (Bloom). If that is true, most children's learning has taken place before their formal education has begun. Piaget has found that a child's mind "is neither a miniature model of an adult's mind nor an empty vessel that gradually fills up with information. It is active from infancy, as the child struggles to understand the complicated world in which he finds himself . . . . " (*Newsweek* 1980). Montessori described a child's play as a meaningful activity. While at play, the parent or teacher can observe children's cognitive development as well as their social, emotional, language, and physical development.

Children need to become actively involved, using all their senses to find out about the world. ***Woolly Bounce*** provides children with a playground environment in which they can become actively engaged. It enables children to playfully explore a ball's bouncing behavior in an undirected, open-ended environment. This program is designed to give children a first-hand experience to challenge their pre-existing notions and to provoke thinking.

This environment enables children to ask and then find their own answers for those very important "what happens if?" questions. Children learn best when the problem or lesson is relevant to them. By providing them an environment they can control and where they can ask their own questions and find their own answers, the situation becomes intrinsically interesting and motivating. In addition, children have different learning styles and learning rates. This environment enables them to experiment with different problem-solving strategies and to do so at their own rate.

Time is an important factor that influences children's involvement. It is important that children have the opportunity to become familiar with the operation and interaction of the program as well as to become immersed in the problem-solving process. The teacher should be careful to monitor the children's progress and to interact only to focus or guide them, asking such open-ended questions as "what do you think happened?" "what happens if . . ?" and "what did you do to make this happen?" Teachers should be careful not to answer the questions they are asked directly, but rather to redirect the questions back to the children: "well, what do *you* think caused that to happen?" It is important for children to know the correct answer; however, it is more important for them to know how to arrive at the correct answer.

Woolly Bounce, like all simulations, is deliberately limited. As a subset of reality, only specific basic factors are allowed to interact in the investigation. The value of a simulation is that it enables children to focus their attention on factors without being distracted by myriad uncontrollable factors that may influence an actual investigation. In doing so, ***Woolly Bounce*** prepares children to have a better understanding of the inquiry process when they are actually engaged in a real classroom activity.

THE PRODUCT AT A GLANCE

Description

In ***Woolly Bounce***, children assume the role of scientists as they set out to discover what factors (variables) influence a ball's bouncing behavior. They have three variables (type of ball, height of fall, and kind of surface) to explore. The simulation allows children to apply basic science inquiry skills while gaining a conceptual understanding of basic physical science concepts.

Like actual scientists, children design systematic experiments to test the influence of the variables on a ball's bouncing behavior. Children use the information they have collected to predict the outcome of other experiments. They also use the information to successfully solve problems that challenge them to demonstrate their understanding.

Woolly Bounce has two instructional programs. Each program has four levels of difficulty, based on the number of variables that children are presented. It is important to remember that not all children should be expected to be developmentally ready to use all the programs in a single session. Kindergarten children may only be ready to use level one of the explore program, while they may only be ready to use the challenge programs in second grade.

Help Woolly Learn enables children to explore the relationships between three variables and a ball's bouncing behavior in an undirected, open-ended environment. The knowledge and understanding gained in this program is applied in the second program. **Match Woolly's Bounce** asks children to apply their understanding by correctly selecting the variable or set of variables that will match a stated number of bounces or first-bounce height.

Title:	***Woolly Bounce***
Grade Level:	K - 2
Subject Area:	Physical Science
Topic:	Bouncing balls (force and motion)
Processes:	Observing, Comparing, Organizing, Relating
Program Type:	Discovery-learning simulation
Hardware:	Apple II series computer with 128K; color monitor is recommended; a printer is optional.
Classroom Use:	Individual students or small groups

THE PRODUCT AT A GLANCE (continued)

LEARNING OBJECTIVES

When using this courseware, children will practice:

- observing, hypothesizing, forming and testing models, and designing experiments;
- collecting, organizing, and interpreting data in order to solve a problem;
- identifying three influences of bouncing behavior; and
- predicting the relationship between the three variables (type of ball, height of fall, and kind of surface) on a ball's bouncing behavior.

DESCRIPTION OF THE INSTRUCTIONAL PROGRAMS

Woolly Bounce consists of two instructional programs, **Help Woolly Learn** and **Match Woolly's Bounce**. The two programs feature a similar format and method of student interaction.

Help Woolly Learn is an unguided and open-ended learning environment in which children can freely explore the results of dropping various balls, from selected heights, on a hard or soft surface (floor). To be successful, children will need to practice their science inquiry skills: designing experiments; observing, recording, organizing, and analyzing information; predicting; and formulating and testing models. The goal of the explore program is for children to develop an understanding of these relationships by collecting and analyzing the data they generate.

Help Woolly Learn includes four levels of difficulty. The difficulty level is based on the number of variables that the children encounter.

Number	*Color*	*Student Selected*	*Pre-selected*
Woolly One	Blue	Type of ball	Drop height (maximum) Type of floor (hard)
Woolly Two	Orange	Type of ball Drop height	Type of floor (hard)
Woolly Three	Violet	Type of ball Type of floor	Drop height (maximum)
Woolly Four	Green	Type of ball Drop height Type of floor	None

Children can move from this program to the challenge program and/or return to the explore program at any time. In essence, **Help Woolly Learn** is an independent-learning version and preparation for the challenge program.

Match Woolly's Bounce is a guided-inquiry or challenge program that requires children to demonstrate the knowledge and understanding they have gained in **Help Woolly Learn**. Children are asked to solve a specific problem using their knowledge of how the type of ball, drop height, and kind of surface influence the bouncing behavior of the balls. There are four levels of difficulty, based on the number of variables that the children are expected to deal with (see chart above).

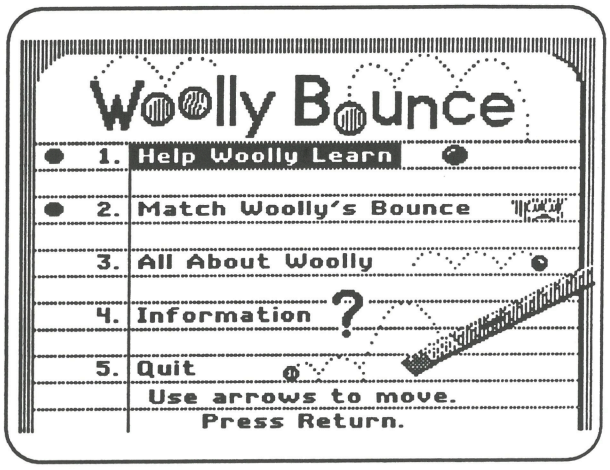
Woolly Bounce is designed to be integrated into your own classroom lesson plans. It is assumed that children will receive both preparation and guidance while using the programs. ***Woolly Bounce*** is designed to emphasize the use of science inquiry skills. The hope is that children will use their investigatory experiences to gain an understanding of the concepts and principles involved in the real world by "doing science" in similar hands-on classroom investigations. This manual includes textbook correlation information and classroom activities that will enable you to easily integrate these programs into your own hands-on science program. ***Woolly Bounce*** can be included as a preparation for a student investigation or a means of summarizing or reviewing a student investigation.

A QUICK LOOK AT *WOOLLY BOUNCE*

This section provides a general description of the two instructional programs included in ***Woolly Bounce***. Each program has a similar screen format and method of interaction. To begin using one of these programs, place the disk in the disk drive, turn on the computer, and proceed to the main menu. This description assumes that Data Collection in the Teacher's Options has been turned on and that automatic menus have not.

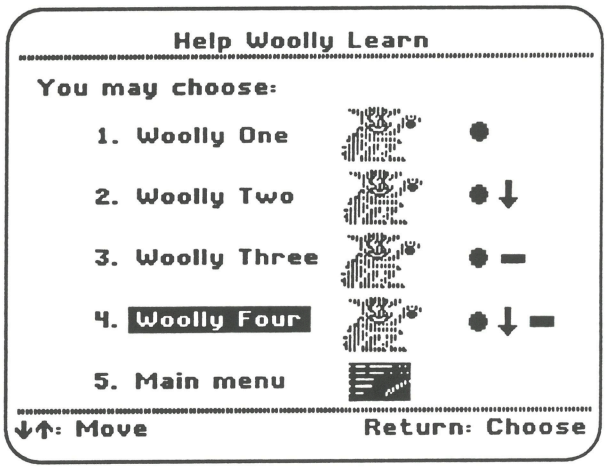
Main Menu

The main menu displays five options. Option 1 begins the **Help Woolly Learn** program. Option 2 begins the **Match Woolly' Bounce** program. Option 3, **All About Woolly**, is a limited demonstration of the program. Option 4, **Information,** provides a program description and MECC product information. Option 5, **Quit**, ends the current session of ***Woolly Bounce***.



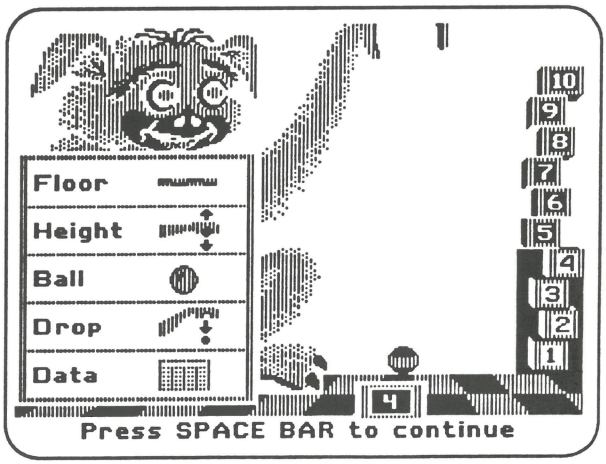
Help Woolly Learn

Choosing **Help Woolly Learn**, Option 1, from the main menu displays a second menu from which one of four levels of difficulty can be selected. The levels are indicated by a Woolly number, Woolly color, and an icon for each student selected variable (see page 7). After selecting a program from the main menu, children can enter or verify their names if the Student Records Option has been selected in Teacher Options (see page 15).



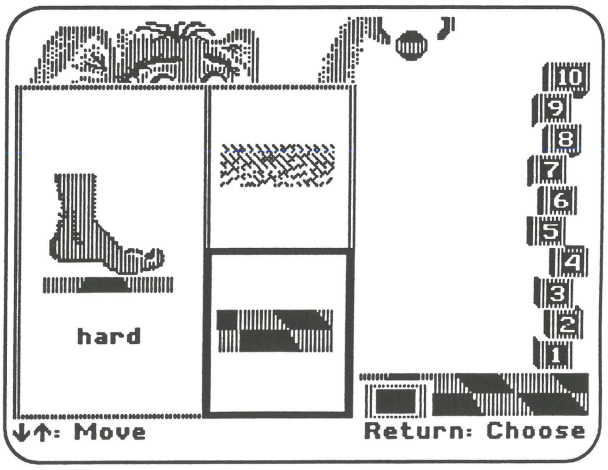
After selecting a difficulty level, the **Help Woolly Learn** interaction screen is displayed. The Woolly Four interaction screen shown here displays five Action buttons on the menu bar: "Floor," "Height," "Ball," "Drop," and "Data." These buttons enable children to carry out their investigations.

The task is to discover how each displayed variable influences the height of the first bounce and the number of bounces of a given ball.

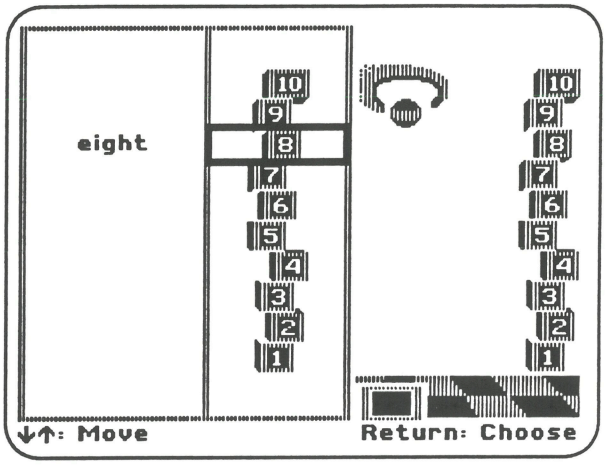


A QUICK LOOK AT *WOOLLY BOUNCE* (continued)

Use the Up- or Down-Arrow Key to move the cursor through the displayed Action buttons. Select the Floor button and press Return to view the Floor menu. When the Floor menu appears, use the arrow keys to select a soft or a hard floor. As the cursor box moves up and down, the soft or hard floor graphic appears correspondingly. When the desired floor is selected, press Return to view the experiment screen.

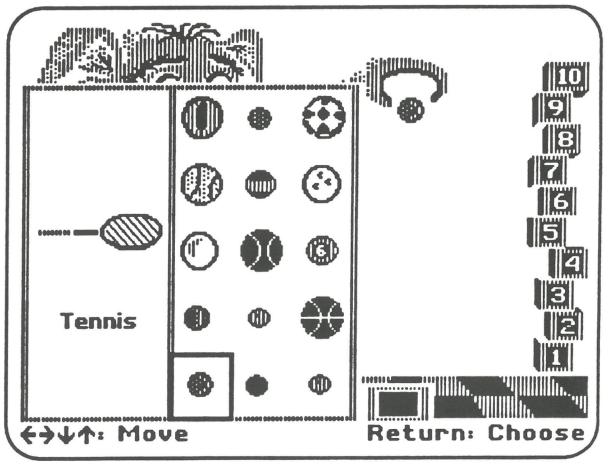


Use the arrow keys to select the Height button and press Return to view the Height menu. When the Height menu appears, use the arrow keys to select a height to drop the ball from. *The type of scale displayed (blocks or ruler-like scale) is selected in Teacher Options (see page 15).* As the cursor box moves up and down the scale, Woolly's hand moves and the word for the number appears correspondingly. When the desired unit is selected, press Return to view the experiment screen.



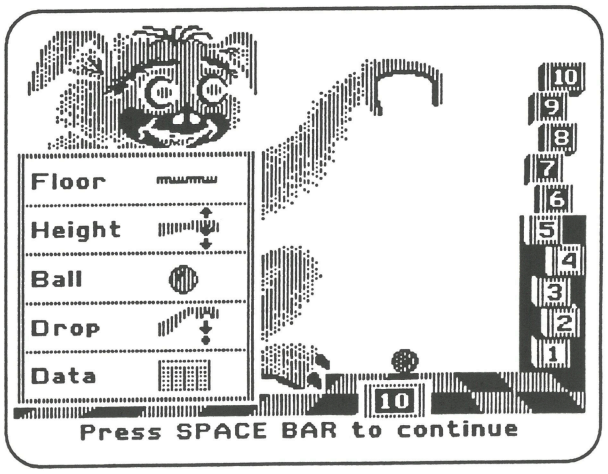
Use the arrow keys to select the Ball button and press Return to view the Ball menu. When the Ball menu appears, use the arrow keys to select one of the 15 balls. As the cursor box surrounds a ball, that ball appears in Woolly's hand, and the name and a matching graphic appear on the left. When the desired ball is found, press Return to view the experiment screen.

Note: In Woolly One, Two, or Three, the type of ball and/or the kind of floor may have been randomly pre-selected (see page 7).



A QUICK LOOK AT *WOOLLY BOUNCE* (continued)

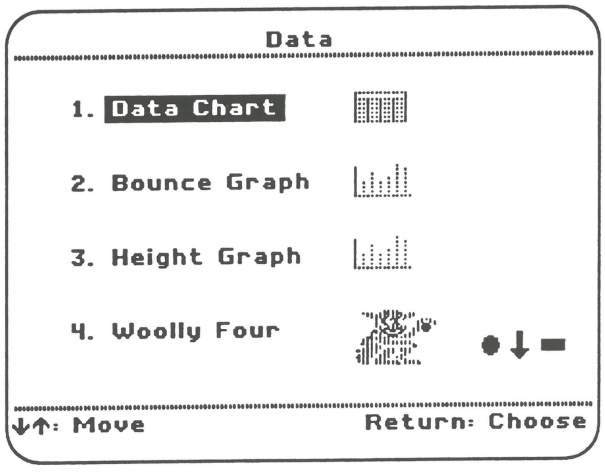
The investigation begins when the Drop button is selected. At that point, three events can be observed: the ball drops, the height of the first bounce is recorded on the scale, and the number of bounces is recorded in the box on the floor. When the ball stops bouncing, press the Space Bar to continue experimenting. The children can drop the ball from the same height or select a new height, new ball, or new floor as many times as they want.



Teacher Hint:
Encourage the children to start at the easiest level and to work at enough problems to become confident in their understanding of the program before attempting to work at more difficult levels.

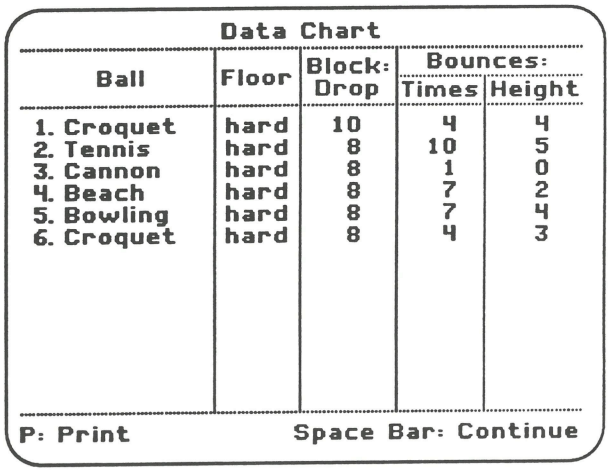
Information about each trial (each time a ball is dropped) is recorded by the computer. Use the arrow keys to select the Data button and press Return to view the data menu. The Data button is displayed after the first ball is dropped. *Whether or not the Data button is displayed for children to use is selected in Teacher Options (see page 15).*

When the data menu appears, use the arrow keys to select one of the three data options or return to the experiment screen. There are three data options: Data Chart, Bounce Graph, and Height Graph.

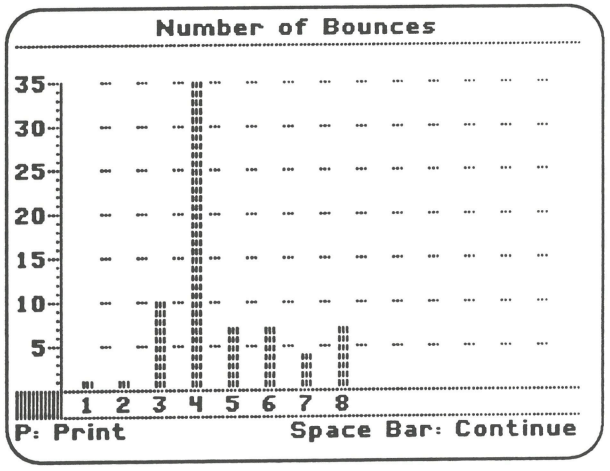


A QUICK LOOK AT *WOOLLY BOUNCE* (continued)

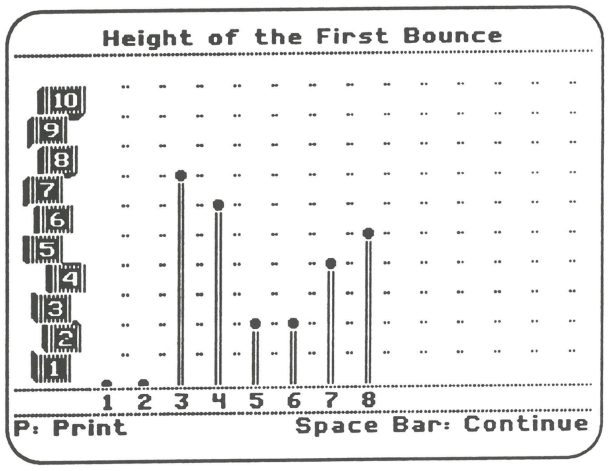
Use the arrow keys to select the Data Chart Option and press Return to view the Data Chart. The Data Chart enables children to see at a glance the conditions that were selected and the results for each of up to thirteen trials. Press the Space Bar to return to the Data menu.



Use the arrow keys to select the Bounce Graph Option and press Return to view the Bounce Graph. The Bounce Graph enables children to see at a glance the results of up to thirteen unlimited trials. Each stack of dots represents the number of bounces in one trial. Press the Space Bar to return to the Data menu.



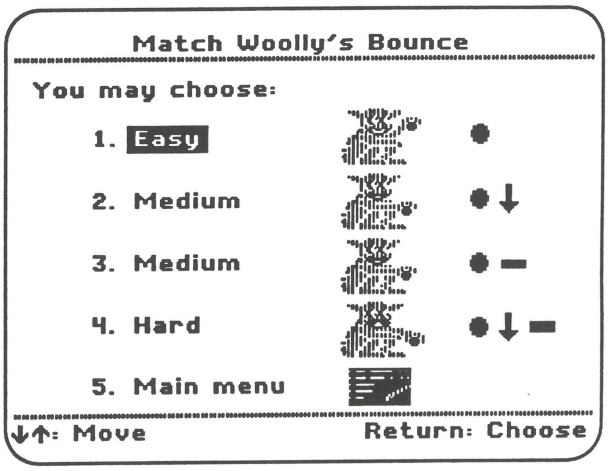
Use the arrow keys to select the Height Graph Option and press Return to view the Height Graph. The Height Graph enables children to see at a glance the results for each of up to thirteen trials. Each vertical line represents one trial and the height to which the ball bounced. Press the Space Bar to return to the Data menu.



Note: The Chart and Graphs display results for thirteen events. After the thirteenth event the data will begin to be erased. The oldest record will be replaced by the newest record until a new set of data is collected, and then the process will begin again. If selected in Teacher Options, these screens can be printed by the children.

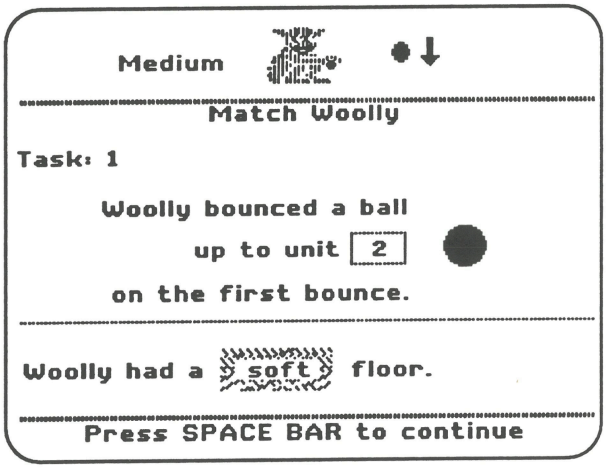
Match Woolly's Bounce

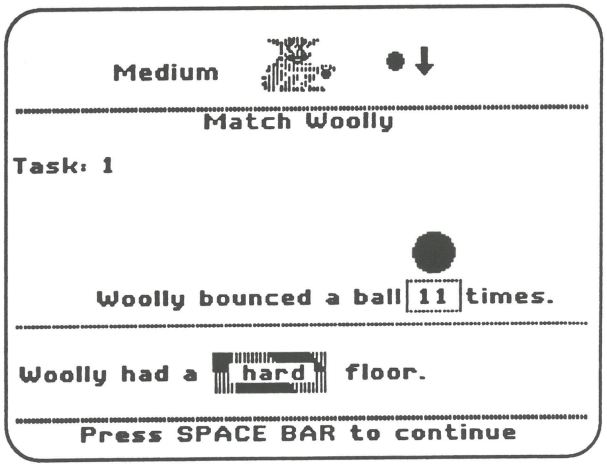
Choosing **Match Woolly's Bounce**, Option 2, from the main menu displays a second menu from which one of four levels of challenges can be selected. The levels are indicated by a one-word description, a blue Woolly (showing effort), and an icon for each user-selected variable (see page 7).



On selecting a level, children can enter or verify their name (if the Student Records Option has been selected in Teacher Options, see page 15).

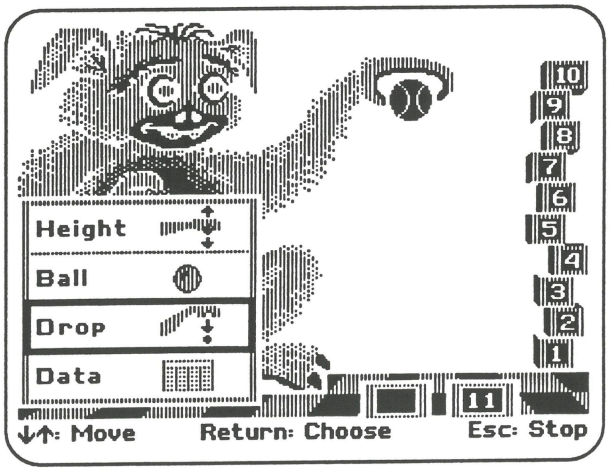
After selecting a level, a challenge is presented. Two kinds of challenges are alternately presented. The child's task will be to match a set of conditions that will result either in a ball bouncing a given number of times or a ball bouncing up a given number of units on the first bounce. On levels one, two, and three, the conditions (that is, the variables that are controlled by the program) are also given. The presentation of each task is animated to facilitate non-readers. Each level of difficulty requires the children to deal successfully with one, two, or three variables.



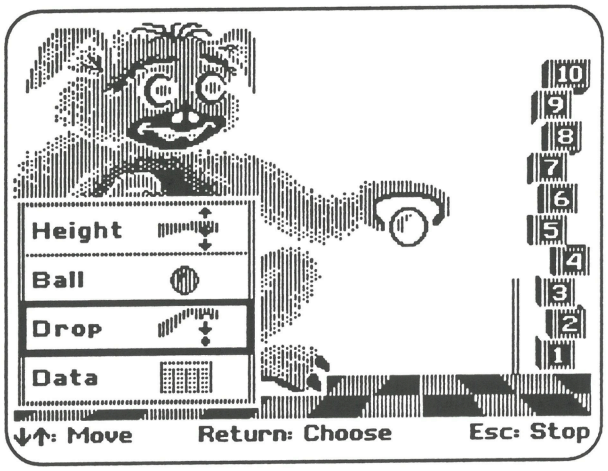


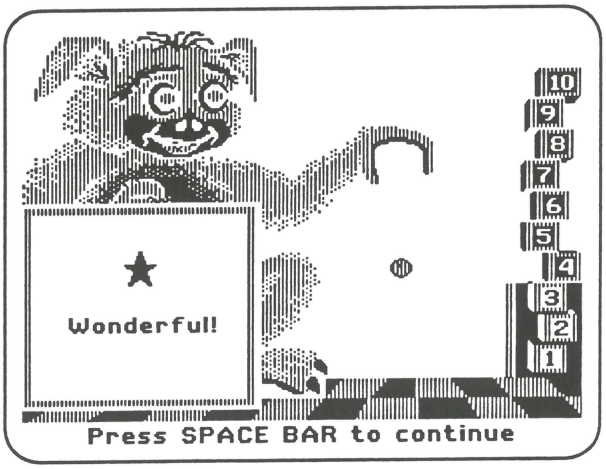
A QUICK LOOK AT *WOOLLY BOUNCE* (continued)

By pressing the Space Bar on the challenge problem screen, the **Match Woolly's Bounce** interaction screen is displayed. Challenges that deal with the number of bounces display two boxes in the floor. The box on the right displays the target number of bounces; the box on the left counts the actual number of bounces. Challenges that deal with the height of the first bounce display a green bar just to the left of the scale, indicating the targeted height. As in the experiment program, the actual height is shown with an inverse bar.



The children have three chances to correctly meet a given challenge. If trial data is being collected, they can select the Data button to review the data collected during the current challenge problem. When a new problem is presented, all previous data is erased. When they correctly meet the challenge, they are presented with a congratulatory message. When they are unsuccessful, they are given appropriate feedback and asked to try again. After successfully or unsuccessfully attempting a challenge problem, a new problem is presented.

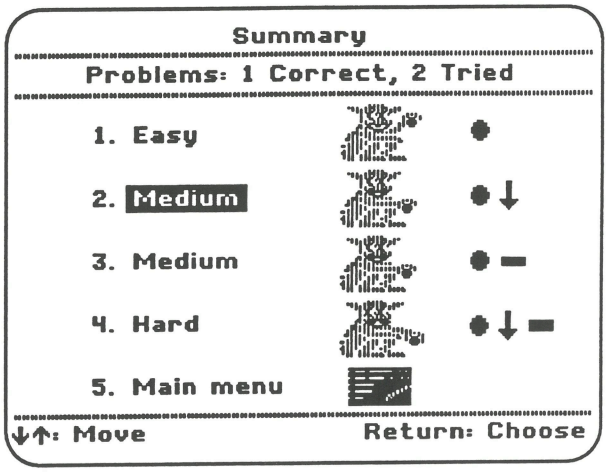




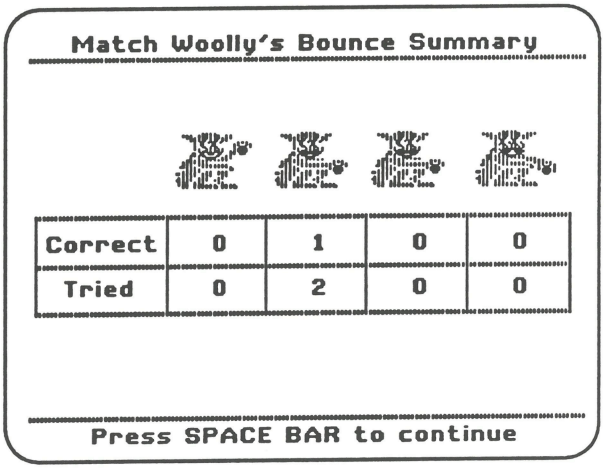
A QUICK LOOK AT *WOOLLY BOUNCE* (continued)

Pressing the Escape Key from the **Match Woolly's Bounce** interaction screen displays a summary of the child's progress on the currently selected level and five options from which to choose.

If Escape was pressed before a problem was solved or a session of three tries was ended, reselecting that same level returns the child to complete that problem. The children can, however, select a new level or return to the main menu.



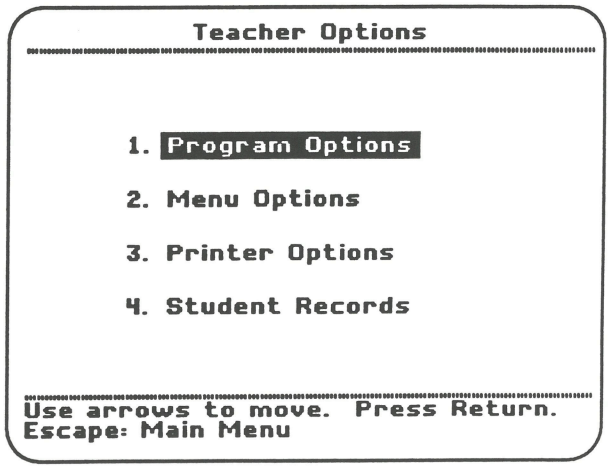
When Option 5, main menu, is selected, a summary of the child's progress on all challenge levels attempted during this computer session is displayed. Student Record information can be printed by you through the Teacher Options.



Frightened Ball

Teacher Options

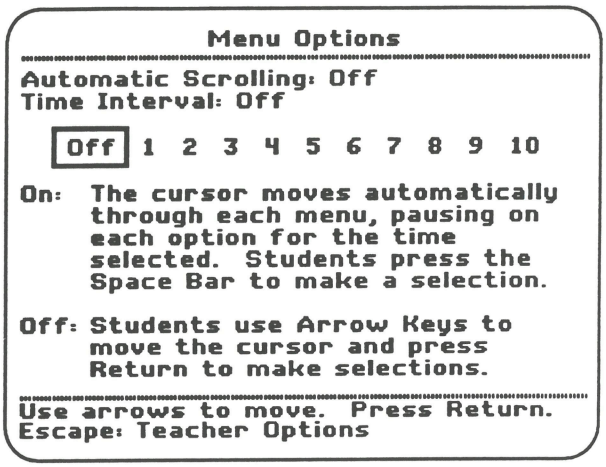
Teacher Options can be accessed from the main menu by typing Control-A (press the Control Key and A Key simultaneously). The Teacher Options menu enables you to access four options.



Program Options, Option 1, provides you with the ability to control four aspects of the programs. You can elect to:

1. display a block or a ruler-like scale;
2. turn student printing on or off;
3. turn student records on or off; and
4. turn trial data collection on or off.

Menu Options, Option 2, provides you with the ability to enable either "standard menus" (selections are made manually with the arrow keys and Return Key) or "automatic menus" (the cursor automatically moves through the menus, and selection is made with the Space Bar). Automatic menus may be helpful for early elementary children or children with limited mobility.


Menu Options
Automatic Scrolling: Off
Time Interval: Off
Off 1 2 3 4 5 6 7 8 9 10
On: The cursor moves automatically through each menu, pausing on each option for the time selected. Students press the Space Bar to make a selection.
Off: Students use Arrow Keys to move the cursor and press Return to make selections.
Use arrows to move. Press Return.
Escape: Teacher Options

Printer Options, Option 3, allows you to print (see "Using a Printer with This Courseware," beginning on page 49).

In Student Records, Option 4, the instructional programs can store information on student progress for up to 75 students if Keep Records has been chosen under Program Options (see above). Choosing Option 4 from the Teacher Options menu takes you to the Student Records menu where you may see, print, or erase student records.

Student Records contains the students' names, the program(s) and level(s) they selected, and the results. **Help Woolly Learn** stores the number of trials attempted on each level. **Match Woolly's Bounce** stores the number of problems solved and the number of problems attempted on each level. (4/5 means that 4 problems were solved out of 5 problems that where attempted.)

Note: Turning Student Records off in Teacher Options does not erase those records already stored on the disk.

Any setting changes you make in Teacher Options will remain in effect until the option is accessed and the settings changed again.

USE IN AN INSTRUCTONAL SETTING

This section describes the instructional approach of ***Woolly Bounce*** and provides additional information about using the program effectively in an educational setting. Information on the effective use of ***Woolly Bounce*** is divided into several sections: "Preparation," "Using the Programs," "Student Strategies," "Classroom Activities," "Program Activities," and "Related Activities."

Woolly Bounce is designed to be used in conjunction with a textbook chapter or unit and/or other classroom activities related to science inquiry skills, force and motion, bouncing balls, energy, potential and kinetic energy, physical properties, cause and effect, or related concepts and principles. It can be used at the beginning of the unit to introduce the topic or at the conclusion of the unit to reinforce important principles.

The strength of any instructional software lies in the manner in which it is used in the classroom environment. The emphasis of ***Woolly Bounce*** is on presenting children with a problem-solving simulation that promotes discovery learning and reinforces science process skills. The program directly supports and complements actual hands-on experimentation in the classroom. As a teacher, you can choose to present the concepts by using the computer, conducting hands-on experiments, or by using a combination of these two methods. The supportive and complementary nature of ***Woolly Bounce*** gives you the opportunity to create a powerful and flexible instructional environment.

Several methods for classroom implementation of the program are mentioned below. These ideas represent suggestions. The actual selection and sequencing of activities remains up to you, so that you can tailor the instruction to meet the needs of your students. In a similar manner, how much direction you give to your students depends on their level of readiness. Some children benefit from a teacher-directed approach, while others function best when allowed to explore and develop their own problem-solving strategies.

Preparation

Although primarily designed for students in grades K-2, students of many age levels may benefit from effective use of ***Woolly Bounce***. Since many of the concepts introduced in ***Woolly Bounce*** are presented in greater detail in upper elementary and junior high physical science classes, you may want to use these programs to introduce those processes. Very little "scientific" terminology has been used in these programs, and it is not necessary that the children memorize terminology to be successful. Some concepts such as gravity, energy, potential energy, kinetic energy, and compression could be introduced to older children before or after using ***Woolly Bounce***. Some teachers will prefer to first introduce children to the concepts and principles through these student-centered activities. Only after the children have shared a common set of experiences should the teacher provide them labels for the concepts that they now understand.

Children who are new to ***Woolly Bounce*** will benefit from a review of the concepts included and a short demonstration of the program to be used. The Demonstration Option, found on the main menu, is designed to help in this kind of introduction. Non-readers will need to have the displayed text read to them.

USE IN AN INSTRUCTIONAL SETTING (continued)

Nine worksheets (pages 40-48) are included in this manual to be used as part of an introduction to and investigations with ***Woolly Bounce.***

Using the Programs

Encourage children with number recognition and writing skills to collect data by keeping a record of the ball they used, the number of bounces, and the first-bounce height. Maintaining records forces them to think about the selections they have made and the events they have observed. Most children will find these records helpful for analysis and discussion. Encourage them to use good scientific procedure by changing variables in a thoughtful and orderly manner. Also encourage them to begin with the **Help Woolly Learn** program to develop self-confidence before attempting the more difficult challenge programs. The "What I Found Out" worksheets may help children to organize investigations and record keeping.

Student Strategies

As a discovery-learning simulation, ***Woolly Bounce*** provides children with an open environment for experimenting with and developing successful problem-solving strategies. During classroom-testing sessions, children exhibited a wide variety of approaches to the problem of learning about the bouncing characteristics of balls. Common successful strategies included the following:

- Some children preferred to work in cooperative groups or pairs. In many instances, teams tended to be more successful, or at least successful sooner, than children who worked alone.

- Children tended to explore extremes. They tried to find the biggest ball or the smallest ball. They tried to find the ball that bounces the most or the least, the highest or the lowest. After making these "discoveries," they felt that they "understood." It became evident in the challenge programs, however, that they did not understand the relationships well enough to be able to locate a specific type or combination of ball, height, and floor that would produce an intermediate result. Encourage children to explore as many relationships as possible in the **Help Woolly Learn** program or to return to it when they need more experience.

Although individual approaches vary greatly, each type of successful approach commonly features careful observation (and, if possible, record-keeping) and analysis. Some children, however, do not readily develop these successful strategies on their own. Classroom discussions are very important to help children understand both the problem-solving processes and the information they have gained. Encourage children to share both successful and unsuccessful strategies.

USE IN AN INSTRUCTONAL SETTING (continued)

Classroom Activities

Many student-centered classroom activities can be used to complement and strengthen the instructional objectives and processes presented in ***Woolly Bounce***. Some activities can be used as introductory lessons. Others can become long-term classroom activities. The selection and order of the activities depends upon your specific classroom environment.

The true value of these activities lies in the ideas, comments, and questions that arise from discussing shared experiences. Allow sufficient time during and after using ***Woolly Bounce*** and each additional activity for children to share their observations, approaches, and findings. This interaction can be encouraged by having children work together in cooperative groups and by informing them that discussion sessions will follow the activity.

Discussion Sessions

Engage your students in a discussion of their findings, using such questions as:

- Which ball bounced the most/least?
- Which ball bounced the highest/lowest?
- Which balls had similar results?
- Did balls with similar results look alike?
- Was the second bounce as high as the first?
- Did the height from which a ball was dropped make a difference?
- Did the kind of floor the ball was dropped on make a difference?
- Did they discover a relationship between the number of bounces or the height of the first bounce and the height from which a ball was dropped?
- Did they discover a relationship between the number of bounces or the height of the first bounce and the kind of floor that was used?
- Did they discover a relationship between the number of bounces or the height of the first bounce and the properties of the ball that was used?

Local Communities and Sports

- What kind of ball-sports are played in your community?
- What kind of ball is used in their favorite sport(s)?
- What would happen if their favorite sport were played with a different kind of ball?
- Would it make a difference if a tennis ball or a basketball bounced more or less than it does? Higher or lower?

Interdisciplinary

- Have your students create drawings, models, stories, poems, or songs that illustrate the concepts and principles they have investigated.
- Invite a speaker(s) to class to inform your students of the ways that these principles and processes are used in some sports and careers.
- Invent new ball games with familiar balls, based on their ability to bounce.

USE IN AN INSTRUCTIONAL SETTING (continued)

Program Activities

As the target grade range indicates, the programs include aspects that are appropriate for kindergarten children and aspects that will challenge children in the second grade. Therefore, it is not expected that all children will immediately be successful in every program in one session. Depending upon the age and ability of your students and your time limitations, you may want to follow a progression of computer activities similar to those described below. Even upper elementary children may need to be introduced to these programs in staged activities over several sessions.

It is also important to recognize when and to what degree the children are ready for formal investigations. Whether or not the children formally record and analyze information on the events they observe, the goal is that the children learn and practice science inquiry skills while gaining a good conceptual understanding of the bouncing behavior of balls, that is, that different kinds of balls bounce differently, depending upon the kind of floor on which a ball falls and the distance the ball is dropped. The eight experiment and challenge programs provide children the opportunity to carry out their investigations with one, two, or three variables.

Formal investigation procedures, such as recording the number of bounces and the height of the first bounce, graphing the information, arranging data in graphs and charts to display patterns, and making formal reports, can be introduced in progressive stages through each of the four **Help Woolly Learn** programs with their targeted level difficulties.

Match Woolly's Bounce evaluates the children's understanding through challenges that are also divided into four levels of difficulty. The four challenge levels are not, however, intended to be matched to the four levels of the **Help Woolly Learn** programs; that is, children completing Woolly One do not need to proceed to the Easy Woolly Challenge. The challenge programs should be attempted only when it is evident that the children have reached a sufficient level of skill readiness to progress from the easy to the hard level. Also see "Student Performance Evaluation" on page 25.

I. Explore Woolly One, An Informal Investigation

The objective of this activity is an informal investigation to introduce children to the program and to the science process skills of observing and of collecting, organizing, and analyzing information. Woolly One has only one variable that the children can change; the program controls the selection of the type of floor and the drop height.

This is a non-threatening opportunity for children to explore the program options and to begin carefully investigating the bouncing characteristics of the set of balls that are available to them. This is also an opportunity to begin developing their own problem-solving strategies. It is recommended that this program be used in conjunction with a related textbook unit or chapter and other related classroom hands-on activities.

USE IN AN INSTRUCTIONAL SETTING (continued)

I. Explore Woolly One, An Informal Investigation (continued)

Begin by briefly demonstrating what a Woolly does. You can do this by going through the demonstration that can be selected from the main menu and/or by selecting Woolly One (the blue Woolly). Our experience during classroom testing seems to indicate that children quickly become very comfortable using the program after only a minimum of keyboarding practice.

Allow the children sufficient time (20-25 minutes or more) to become familiar with the program's options and the content of the program by investigating in an unguided manner the bouncing behavior of the balls. In Woolly One, children can select one variable: the type of ball they wish to use. The program always selects a hard floor and a drop height of 10 units (or 20 units, if the ruler-like scale has been selected in Teacher Options).

Each time a ball is selected, it is immediately placed in Woolly's hand. Each time the ball is dropped, two events are recorded: (1) the height of the first bounce is marked on the vertical scale, and (2) the number of bounces is recorded in the box on the floor.

Note: "A bounce" is defined as an event where a ball falls, strikes the floor, and rebounds upward. A ball that strikes the floor and does not rebound is not recorded as having bounced—whether it is the first or last time it strikes the floor.

The "height of the first bounce" is measured from the bottom of the ball, and the height is always recorded in whole units. The actual bounce height may be rounded up or down to avoid fractional displays. For example, a ball that bounces past unit 6 but not halfway through unit 7 will be recorded as having bounced up 6 units. *A bounce of less than one-half unit is recorded as zero.*

While the children are engaged in their investigations, move around the room to observe their interaction with the program. Where necessary, direct or redirect their attention with open-ended questions about what they are doing. Unlike adult behavior, it is evident that young children do not understand that repeating the same activity with the same parameters will produce the same results. They need to perform the same action repeatedly in order to assure themselves that the results will always be the same. At a point where adults would be bored, children are still learning. As a result, children in classroom testing were observed to drop the same ball repeatedly and were surprised at the result each time. They also seemed to focus on one event, either the bouncing or the height of the first bounce.

As you move around, ask the children to predict how many times the ball will bounce or how high the ball will bounce. Ask them to find out which ball bounces the highest or bounces the greatest number of times.

Conclude the session with at least a ten-minute discussion of what they did. Ask them to share their experiences with the whole class. Some questions might be: What balls did they choose? What was their favorite ball? What was their least favorite ball? What ball bounced the most? What ball bounced the least? What ball bounced the highest? What ball bounced the lowest? Try to correlate today's activities with their past experience. Have them relate some of the experiences they have had using real balls. Can they tell you that they understand that different kinds of balls bounce differently?

USE IN AN INSTRUCTIONAL SETTING (continued)

II. Explore Woolly One, Beginning a Formal Investigation

The objective of the following activity is to introduce children to the program, to begin a formal investigation into the bouncing behavior of a set of balls, and to begin learning and practicing the science process skills of observing and of collecting, organizing, and analyzing information.

This is an opportunity for children to explore the program options and to begin carefully investigating the bouncing characteristics of the set of balls available to them. This is also an opportunity for them to begin developing their own problem-solving strategies. It is recommended that this program be used in conjunction with a related textbook unit or chapter and other related classroom hands-on activities.

Begin by briefly demonstrating how Woolly investigates bouncing balls. You can do this by going through the demonstration that can be selected from the main menu and/or by selecting Woolly One (the blue Woolly). Our experience in classroom testing seems to indicate that children quickly become very comfortable using the program after only a minimum of keyboarding practice.

Duplicate and distribute copies of Worksheet One, "What I Found Out" (page 40). At your discretion, the children can be directed to collect data on the number of bounces, the height of the first bounce, or both. Allow the children sufficient time (20-25 minutes or more) to become familiar with the program's options and the content of the program by investigating in an unguided manner the bouncing behavior of the balls. In Woolly One, the program always selects a hard floor and a drop height of 10 or 20 units, depending upon which scale has been selected in Teacher Options.

Conclude the session with at least a ten-minute discussion of what the children did. Ask them to share their experiences with the whole class. Ask open-ended questions that will lead them to think about their experience and to consult their worksheets. Some questions might be: What balls did they choose? What was their favorite ball? What was their least favorite ball? What ball bounced the most? What ball bounced the least? What ball bounced the highest? What ball bounced the lowest? Try to correlate today's activities with their past experience. Have them relate some experiences they have had using real balls. Can they tell you that they understand that different kinds of balls bounce differently?

III. Explore Woolly Two, The Influence of Height

Woolly Two has two variables that the children can change. The program only controls the selection of the type of floor (hard). Your students can select the type of ball and the height the ball can be dropped from. The ball can be dropped from a maximum distance of 10 or 20 units, depending upon which distance you select in Teacher Options.

Lead a brief discussion on their experience in Woolly One. Have the children summarize what they have learned and the strategies they found most successful. Encourage them to make use of the understanding they have gained and the strategies they have used in the previous program.

USE IN AN INSTRUCTIONAL SETTING (continued)

III. Explore Woolly Two, The Influence of Height (continued)

The object of this investigation is to determine if and how dropping a ball from various heights influences the bouncing behavior of a ball. Depending upon the readiness of your students, duplicate and distribute from among Worksheets Two, Three, or Four, "What I Found Out—Hard Floor" series (see pages 41-43).

Allow the children sufficient time (30 minutes) to become familiar with the program's options in an unguided manner and to investigate and record the bouncing behavior of the balls.

Conclude the session with at least a ten-minute discussion of what they did. Ask them to share their experiences with the whole class. Ask open-ended questions that will lead them to think about their experience and to consult their worksheets.

Some questions might be: What balls did they choose? What was their favorite ball? What was their least favorite ball? From what height did the ball bounce the most? From what height did the ball bounce the least? From what height did the ball bounce the highest? From what height did the ball bounce the lowest? Try to correlate today's activities with the children's past experience. Have them relate some of their experiences with real balls. Can they summarize in their own words that different kinds of balls bounce differently? Can they summarize in their own words how the height from which a ball is dropped influences its bouncing behavior?

Graphing student-collected data can help children to recognize and understand trends and patterns. The program will automatically collect, chart, and graph student-collected data. This option can be displayed on the menu bar when you select "Collect Trial Data " in Teacher Options. Children can view the chart and graphs on screen or print them to be analyzed on paper. Although computer-generated charts and graphs look very nice, children can often learn to recognize patterns better when they make their own graphs. If possible, have the children make, or help you make, pictographs based on the data they collected. Let the children discuss what the graphs represent.

IV. Explore Woolly Three, The Influence of Surface

The object of this investigation is to determine if and how dropping a ball on a hard or soft surface influences the bouncing behavior of a ball. Depending upon the readiness of your students, duplicate and distribute the "What I Found Out" worksheet (see page 40).

Woolly Three has two variables that the children can change. The program controls the distance the ball will fall. Your students can select the type of ball and the type of floor. The ball will be dropped from a maximum distance of 10 or 20 units, depending on which distance you select in Teacher Options.

USE IN AN INSTRUCTIONAL SETTING (continued)

IV. Explore Woolly Three, The Influence of Surface (continued)

Lead a brief discussion on the children's experience in Woolly One and/or Woolly Two. Have the children summarize what they may have learned and the strategies they may have found most successful. Encourage them to make use of the understanding they have gained and the strategies they have used in the previous program.

Allow the children sufficient time (30 minutes) to become familiar with the program's options in an unguided manner and to investigate and record the bouncing behavior of the balls.

Conclude the session with at least a ten-minute discussion of what they did. Ask them to share their experiences with the whole class. Ask open-ended questions that will lead them to think about their experience and to consult their worksheets. Some questions might be: What balls did they choose? What was their favorite ball? What was their least favorite ball? From what height did the ball bounce the most? From what height did the ball bounce the least? From what height did the ball bounce the highest? From what height did the ball bounce the lowest? Try to correlate today's activities with their past experience. Have them relate some of their experiences with real balls. Can they summarize in their own words that different kinds of balls bounce differently? Can they summarize in their own words how the height from which a ball is dropped influences its bouncing behavior?

Graphing student-collected data can help children to recognize and understand trends and patterns. The program will automatically collect, chart, and graph student collected data. This option can be displayed on the menu bar when you select "Collect Trial Data" in Teacher Options. Children can view the chart and graphs on screen or print them to be analyzed on paper. Although computer-generated charts and graphs look very nice, children can often learn to recognize patterns better when they make their own graphs. If you can, have the children make, or help you make, pictographs based on the data they collected. Let the children discuss what the graphs represent.

V. Explore Woolly Four, Testing All Three Variables

Woolly Four enables children to change all three variables. The program does not control the selection of any variable. The object of this investigation is similar to the previous investigations. However, this program enables children to ask their own questions and set up their own investigations with regard to all three variables.

Note: Remind the children that it is good scientific procedure to change only one variable at a time. Allow them, however, to discover that changing more than one variable at a time makes it impossible to tell which change has caused a specific effect.

USE IN AN INSTRUCTIONAL SETTING (continued)

V. Explore Woolly Four, Testing All Three Variables (continued)

Their task is to determine how each variable influences the bouncing behavior of a ball. Depending upon the readiness of your students, duplicate and distribute appropriate worksheets from the "What I Found Out" series (see pages 40-47). Encourage the children to carefully record the information that is gained from each experiment.

Select "Collect Trial Data" in Teacher Options. The Data option will then be displayed on the menu bar and the program will automatically collect, chart, and graph student collected data. If the child has not dropped a ball, no data will be available. As a result, the Data button is not shown and will be unselectable until a ball is dropped and the button appears. The children can view the chart and graphs on-screen or print them to be analyzed on paper.

Although computer-generated charts and graphs look very nice, children can often learn to recognize and understand trends and patterns better when they make their own graphs. Have them make pictographs based on the data they collected; then help them discuss the graphs they have made and understand what the displayed data represent.

Conclude the session with a discussion of their investigations. Ask open-ended questions that will lead them to think about their experience and to consult their worksheets and graphs. Some questions might be:

Identify the type of ball, the height, and floor that resulted in the:

- most bounces;
- least bounces;
- highest first bounce;
- lowest first bounce.

Identify the type of ball, the height, and the floor that resulted in a first-bounce height of:

- 2 units on the ruler;
- 4 units on the ruler;
- 6 units on the ruler;
- 8 units on the ruler;

- 2 blocks;
- 4 blocks;
- 6 blocks;
- 8 blocks.

Have them summarize in their own words:

- that different kinds of balls bounce differently;
- how the height from which a ball is dropped influences the bouncing behavior of a ball;
- how the surface on which the ball is dropped influences the bouncing behavior of a ball.

USE IN AN INSTRUCTIONAL SETTING (continued)

Student Performance Evaluation

How well children have performed using science process skills, thinking skills, and problem-solving skills is often best judged through observing them as they work at the computer or in hands-on activities, as they participate in classroom discussions, and through an examination of their recording sheets, graphs, and reports.

The degree to which the children have been successful in each of the challenge programs can be recorded by the computer if you select that Teacher Option. This information can be used as an objective measure of how well they have met the programs' primary objectives: to provide children with an environment where they can learn and improve their use of science inquiry skills and to have them gain a sound conceptual understanding of how the type of ball, height dropped, and kind of surface can influence a ball's bouncing behavior.

This information can be observed on the summary screens at the end of each challenge session. It can also be viewed and printed through the Teacher Options menu, which can be accessed with a Control-A (pressing the Control Key and A Key simultaneously) while viewing the main menu.

Worksheet Nine, "What I Found Out—Bouncing Conclusions," located on page 48, is provided as an additional measure of assessing the children's understanding.

Silly Ball

USE IN AN INSTRUCTONAL SETTING (continued)

Related Activities

A ball bouncing activity, similar to that performed by Woolly, can easily be performed by children with a minimum of equipment.

Have the children bring several different kinds of balls from home. You can use meter or yard sticks for a vertical scale or you can have the children make their own vertical scales. To make vertical scales, cut two- or three-inch wide strips of white paper or use a role of adding-machine tape cut about a meter long. Give the children a unit template in the form of a piece of colored construction paper that is cut to the arbitrary size of one unit (1, 2, or 3 inches). Have the children mark off units on their strips of white paper using the unit template and a crayon.

The paper scales can be taped to the wall or any other appropriate vertical surface. Assign the children to work in teams of two. One child can drop the ball while the other observes and records the results; then their roles can be reversed. The children can record the number of bounces and/or the height of the first bounce as you judge appropriate. When each type of ball has been investigated, the types can be traded among teams.

First- and second-grade children will benefit from a formal examination of the data they collect. Placing the information in charts and graphing the information will help them to see trends or patterns in the bouncing behavior of the balls.

Conclude the session with a discussion of their investigations. Ask open-ended questions that will lead them to think about their experience and to consult their worksheets and graphs. Some questions might be:

- Identify the type of ball, the height, and floor that resulted in the:

  most bounces, least bounces, highest first bounce, lowest first bounce.

- Identify the type of ball, the height, and floor that resulted in an intermediate first-bounce height, such as:

  2 units, 4 units, 6 units, 8 units;

  or some standard units of measurement, such as:

  2 inches or 3 centimeters.

- Have them summarize in their own words:

  - that different kinds of balls bounce differently;
  - how the height from which a ball is dropped influences the bouncing behavior of a ball;
  - how the surface on which the ball is dropped influences the bouncing behavior of a ball.

USE IN AN INSTRUCTONAL SETTING (continued)

Related Activities (continued)

The Woolly bounce activity can easily be extended to other types of events.

- The balls can be rolled down a ramp.

  Do different kinds of balls roll different distances?
  How does the length of the ramp influence the distance rolled?
  How does the angle of the ramp influence the distance rolled?

- The balls can be thrown.

  Do different kinds of balls travel different distances?
  Does the amount of force used influence the distance traveled?
  Does the angle of the throw influence the distance traveled?

- The balls can be classified by diameter/circumference, weight, or construction.

  Do all large (small) balls bounce in the same manner?
  Do all heavy (light) balls bounce in the same manner?
  Do all solid (hollow) balls bounce in the same manner?

- The balls' construction can be further classified, such as thick- or thin-walled, or more or less dense.

  How does the thickness of the wall influence the ball's bounce?
  How does the density of the ball influence the ball's bounce?

For more information about this an other variations of this investigation, see the activities described in the articles listed in "References" on page 53 and the activities described in "Textbook Correlation" on pages 35-39.

Laughing Ball

THINKING SKILLS

Using MECC Science Products to Reinforce Core Thinking Skills

The MECC science inquiry products have as their primary goal to provide an environment in which students can learn and reinforce the use of science inquiry or science process skills. This set of skills includes observing, collecting or recording data, organizing data, analyzing data, forming hypotheses or predictions, constructing models, and testing models. The purpose of the scientific method is to provide an organized process for approaching problematic situations and determining solutions.

Each step in the inquiry process is, of course, related to and supported by a web of core thinking skills. A good science observer also displays good focusing skills, information-gathering skills, remembering skills, and so on. A good scientist is, therefore, skilled at both appropriate scientific techniques and appropriate thinking skills.

Even though they share some terminology, the science inquiry process specifically relates to what science is and what a scientist does. Core thinking skills are life skills necessary for the well-being of everyone in every situation. One can possess science inquiry skills and be a poor scientist because one has poor thinking skills. Alternatively, having good thinking skills alone does not make one a good scientist. Therefore, science inquiry skills and core thinking skills, though closely intertwined, really present the teacher with two quite different sets of teaching objectives.

While the primary goal of the MECC science products is to highlight and reinforce science inquiry skills, the rich environment each product presents is also well-suited to fostering good thinking skills. As a result, these products can easily be adapted by teachers in any subject area to highlight and to reinforce core thinking skills as outlined in the following pages.

When teaching thinking skills with these science products, please keep in mind that although only one example of the use of a particular thinking skill is correlated to a particular part or use of a program, the same skills can be practiced on many levels and in many aspects of these programs.

Using Computer Software in a Thinking Skills Environment

Teachers are faced with the tremendous task of preparing today's students for tomorrow's world—a world characterized by change in an information-rich environment. Thinking skills are at the heart of this thriving, changing environment, for these are the behaviors students must practice in school and continue to apply for the rest of their lives.

It wasn't long ago that thinking skills were considered exclusive to gifted and enrichment classes. Today, however, thinking skills are viewed as an essential component of the total school curriculum. Developing these skills is the goal of each individual discipline. Many educators have, in fact, come to view thinking skills as perhaps the most basic of the basic skills because they facilitate the acquisition of all other learning.

THINKING SKILLS (continued)

At MECC, we view computer software as a vehicle for fostering students' thinking. Our products are curriculum-based, with thinking skills as a thread within subject areas. This provides an environment with many opportunities for teachers to highlight and reinforce thinking skills.

We believe teachers play a critical role in determining the classroom environment for thinking. Naturally, many teachers have taught thinking skills and will continue to do so using a variety of strategies. Our commitment is to provide teachers with the materials that help them do their job well: high-quality software that promotes the application of thinking skills.

Our approach to thinking skills reflects what both research and effective classroom practice has shown. That is, the approach that is most effective and appeals to most teachers is one that infuses thinking skills into existing content areas. Educators have told us they are interested in thinking skills as a method used in the instruction of a topic, not as a subject. By infusing thinking skills into existing content areas, MECC products integrate easily into teachers' curricula while providing a rich environment for students to practice skillful thinking. We strive to meet the challenge teachers face in promoting the skills that students need.

If schools are to integrate the teaching of thinking with regular academic instruction, they need to know what aspects of thinking to teach. After exploring the research that has been done in the area of thinking skills, MECC has chosen as a base the *Dimensions of Thinking* framework, published in 1988 by the Association of Supervision and Curriculum Development (ASCD). We chose this framework because it pulls together research and models from a variety of sources and brings the theory to the classroom level, applying it to that environment. In addition to knowing the subject matter that is covered, teachers now can see the specific thinking skills that are challenged within a product.

This section of the manual highlights ways in which teachers can use ***Woolly Bounce*** to promote thinking skills with their students. The following pages provide examples of how ***Woolly Bounce*** relates to the ASCD core thinking skills framework. Although only one thinking skill per category is correlated to a specific part of the product, each skill can be practiced on many levels and in many aspects of the product.

We realize the importance of thinking skills in the curriculum. We believe it is essential that students be taught thinking skills so that they have the tools to understand the past, deal with the present, and prepare for the future. We are confident that you will find ***Woolly Bounce*** of considerable value in your classroom as you foster student thinking.

Happy Ball

A Framework for Thinking

The components used in thinking are referred to as *core thinking skills*. This framework defines those skills that appear in the repertoire of the model learner. Each skill selected is documented in research as important to learning or thinking, is teachable, and is valued by educators as important for students to learn.

The core skills of the ASCD framework are listed and defined below with examples of applications within ***Woolly Bounce.*** The skills are neither discrete nor hierarchical. In fact, individual skills draw on other skills and can be used repeatedly in the thinking process. The selected examples are not exhaustive but highlight ways in which these thinking skills are used in ***Woolly Bounce.***

Source: Dimensions of Thinking, Association for Supervision and Curriculum Development (ASCD), 1988.

Definition of Core Thinking Skills Categories	Core Thinking Skills Components	*Woolly Bounce* Application
Focusing Skills allow students to attend to selected pieces of information and ignore others. Focusing occurs when students sense a problem, an issue, or a lack of meaning.	**Focusing Skills** • Defining Problems • Setting Goals	In ***Woolly Bounce***, as students assume the role of scientists, they set out to discover what influences the bouncing behavior of a set of balls. The programs help to focus their attention on three variables: the type of ball, the distance the ball is dropped, and the kind of floor. They can focus on one, two, or three variables at a time.
Information-Gathering Skills involve obtaining information and clarifying issues and meanings through inquiry.	**Information-Gathering Skills** • Observing • Formulating Questions	Students create their own experiments and observe the results. The results of each experiment inevitably lead to the formation of "What if?" questions. Students are encouraged to make their own choices and ask their own questions. The results of each experiment are recorded by the program.
Remembering Skills are those activities or strategies that students consciously engage in to store and retrieve information from long-term memory. Activating prior knowledge falls under this category.	**Remembering Skills** • Encoding • Recalling	As the students set out to find patterns, they recall the results of previous experiments in order to create new experiments. The knowledge and understanding gained in the **Woolly Experiments** program is applied in the **Woolly Challenges** program as students attempt to solve computer-generated problems related to their experiments.

THINKING SKILLS (continued)

Definition of Core Thinking Skills Categories	Core Thinking Skills Components	*Woolly Bounce* Application
Organizing Skills are used to arrange information so that it can be understood or presented more effectively.	**Organizing Skills** • Comparing • Classifying • Ordering • Representing	While attempting to determine how each variable influences the bouncing behavior of a ball, students keep records of each experiment and the results. The information gathered is represented and organized in chart and graph form.
Analyzing Skills are used to clarify existing information by examining parts and relationships. Through analysis, students identify and distinguish components, attributes, claims, assumptions, or reasoning.	**Analyzing Skills** • Identifying Attributes and Components • Identifying Relationships and Patterns • Identifying Main Ideas • Identifying Errors	As students determine how three variables influence the bouncing behavior of a set of balls, they observe and analyze the results of their experiments, identifying trends or patterns. The results can be correlated to the physical properties of a ball, the type of floor, as well as the distance a ball is dropped.
Generating Skills involve using the students' prior knowledge to add information beyond what is given. Connections between new ideas and prior knowledge are made as new information and ideas are recast into new structures.	**Generating Skills** • Inferring • Predicting • Elaborating	By using the information they have collected, the children can draw conclusions and make predictions about the results of experiments before they are concluded. Students are encouraged to analyze results and predict the results of new experiments.
Integrating Skills involve putting together the relevant parts or aspects of a solution, understanding, principle, or composition and incorporating this integrated information into a new understanding.	**Integrating Skills** • Summarizing • Restructuring	Throughout the simulation, students observe the results of their experiments. An on-going analysis of their experiments forms a basis for further investigations. The trends and patterns that they discover lead them to a general conceptual understanding of how the bouncing behavior of a ball is predictable.
Evaluating Skills involve assessing the reasonableness and quality of ideas.	**Evaluating Skills** • Establishing Criteria • Verifying	By repeated investigations, students establish a set of objective criteria for determining what will happen when a ball is dropped. In the open, unguided investigatory environment, students can easily verify the appropriateness of their conclusions.

BACKGROUND INFORMATION

Woolly Bounce is endeavoring to bring two messages to your K-2 students: the importance of science inquiry skills and that certain factors (e.g., type of ball, distance dropped, and kind of surface) influences the bouncing behavior of a ball.

Designing experiments, making careful observations, recording information, organizing and analyzing information, and drawing sound conclusions are all well within the ability of all children on at least an informal basis. ***Woolly Bounce*** provides an environment where children can learn and practice these skills.

Gaining a sound experiential (conceptual) understanding of how these three variables influence the behavior of a bouncing ball is an important step. These concepts must be understood before the more abstract concepts of energy, force, and motion are discussed.

The primary objective is to instruct children in a manner in which they can absorb those concepts and principles that are important in their lives now and will continue to be in the future. For young children, it may be enough for the present that they can understand and can summarize in their own words that different kinds of balls bounce differently and that the distance and bouncing surface have an effect on the way balls bounce.

As the children's skills increase, they can begin to examine the balls more closely, noting the manner of a balls' construction and the materials out of which they are made. They will note that some methods of construction and some materials increase "bounce-ability" while others decrease it.

Many things influence the "bounce-ability" of a ball, including weight, density, elasticity, construction, gravity, distance dropped, air resistance (friction), and bouncing surface. How a ball is constructed and what it is made of is directly related to whether its shape can be compressed when it strikes the floor and how well it can spring back to its original shape on the rebound. A ball that is easily compressed and has little or no elasticity (e.g., a ball of clay) will not bounce at all.

For children whose readiness skills have progressed to allow them to deal with abstract concepts, a ball's bouncing behavior can be explained in terms of energy transfer. There are two states of energy: potential and kinetic. Energy can be transferred from one state to the other. When a child—or a Woolly—picks up a ball and raises it, energy is transferred to the ball. The ball has energy it can use to do something (e.g., drop to the floor). Since the ball isn't doing anything yet, we call it potential (stored) energy. Falling—overcoming air resistance and striking the floor—converts the potential energy to kinetic energy (or energy of motion). When the ball strikes the floor, some of its energy is transferred to the floor. If the ball compresses, its kinetic energy is converted to potential energy. If all, or most, of its energy is transferred to the floor (like that of the clay ball), its motion stops. So, each time a ball falls and rebounds from the floor, it has less and less energy for the subsequent fall and rebound. As a result, if a ball is going to bounce at all, its first bounce will be its highest. A ball that has the best compression and elastic characteristics will transfer the least amount of its energy to the floor and therefore have more energy to bounce higher and more often.

BACKGROUND INFORMATION (continued)

Size and weight are also important variables. A beach ball may have a good ability to compress and rebound; however, because it is not very heavy, little potential energy is transferred to it when picked up. And, because it is very large, it loses a lot of energy during its fall due to air resistance (friction). As a result, the beach ball is not a good bouncer.

If the bouncing surface (floor) is soft, it gives way when the ball strikes it, absorbing much of the ball's energy. If, instead, the surface can compress and rebound to its original position, it enables the ball to compress, converting its supply of kinetic energy to potential energy.

As a result, the ball that bounces the highest and the most number of times is the ball that has the best possible combination of all the variables that influence its ability to first gain and then retain the greatest supply of energy for the longest period of time.

Surprised Ball

FOCUS OF THE MODEL

It is important the children recognize that ***Woolly Bounce*** is a simulation. Simulations, by design, do not convey all aspects of reality. Simplifying the event to eliminate many of the possible variables that can influence an event enables the product to focus the children's attention on the specific aspects defined by the instructional objectives. The simplified nature of the model makes it easier for children to understand the concepts and principles involved. It may also, however, lead to misconceptions; therefore, after your students have used the program, you may wish to discuss these with them. It is important that they discuss why results that they observed in student-centered classroom investigations differ from those "observed" in the simulation.

- ***Woolly Bounce*** has one set of balls that are used in every experiment by every child. Every tennis ball, even those made by the same manufacturer, is not exactly the same. Every tennis ball will not have the same bounce characteristics. If every team of children had a tennis ball taken from the same package, it should be expected that each ball would have slightly different physical characteristics.

- ***Woolly Bounce*** data is based on a set of balls that will, of necessity, be different from those that may be available for your students to use.

- ***Woolly Bounce*** performs every experiment for each child with the same precision. The ball is dropped from an exact height on the same surface at the same place. Since all children cannot be expected to perform an experiment with the same precision, it should be expected that each "real" ball would show slightly different characteristics.

- ***Woolly Bounce*** observes the results, the number of bounces, and the height of the first bounce with precision. Since all children cannot be expected to observe events with the same precision, it should be expected that each team would report slightly different results.

- ***Woolly Bounce*** does not include any extraneous factors that may negatively influence the investigation. There are no drafts. The ball or ruler is not moved. The bouncing surface (floor) is not uneven. The number of factors acting on the investigation is deliberately narrowed for the purposes of focusing the children's attention and having them achieve the product's objectives.

- ***Woolly Bounce*** is based on data collected from similar classroom investigations. However, for the purpose of simplifying the investigation to match the readiness of the children, some behavioral irregularities are not included.

TEXTBOOK CORRELATION

Woolly Bounce is designed to be directly integrated into your regular K-2 elementary science lessons. An appropriate use of ***Woolly Bounce*** can also be extended into grades 3-6. For your convenience, the programs have also been briefly correlated to those grade levels. The following charts correlate the instructional objectives and processes of ***Woolly Bounce*** to specific chapters and units in five popular elementary textbook series (Scott, Foresman; Addison-Wesley; Merrill; Silver Burdett & Ginn; and Holt). By referring to these charts, you can create lessons that directly relate to your classroom activities.

Scott, Foresman

Grade	Chapter	Pages	Processes	Topic
K	9	36	Observing Comparing	How things move.
1	1	8-23	Observing Comparing Inferring	Your senses and learning about things.
1	8	144-165	Observing	Moving and working.
1	8	145	Comparing	You can move objects.
1	8	146	Observing Comparing	Objects can move up and down.
1	8	151	Observing Comparing	You can lift objects.
1	6	124-127	Observing Inferring	What can machines do? Machines can be used to change an object's position.
1	6	138-139	Observing Comparing	Reading a timer and making a graph.
3	6	114-128	Observing	Work and machines.
Activity	6	115	Observing Comparing	Observing how people move objects.
Activity	6	128	Observing Comparing	Observe the force needed to move an object with a lever.
4	5	128-129	Observing Comparing	How is length measured?
4	6	142-159	Observing	Work and energy.

TEXTBOOK CORRELATION (continued)

Scott, Foresman (continued)

Grade	Chapter	Pages	Processes	Topic
Activity	6	143	Observing Comparing	Observing moving and still objects.
Activity	6	152	Comparing	Measuring work.
5	7	180-201	Observing Comparing	Changing forms of energy.
Activity	7	181	Observing Comparing	Observing energy and work.

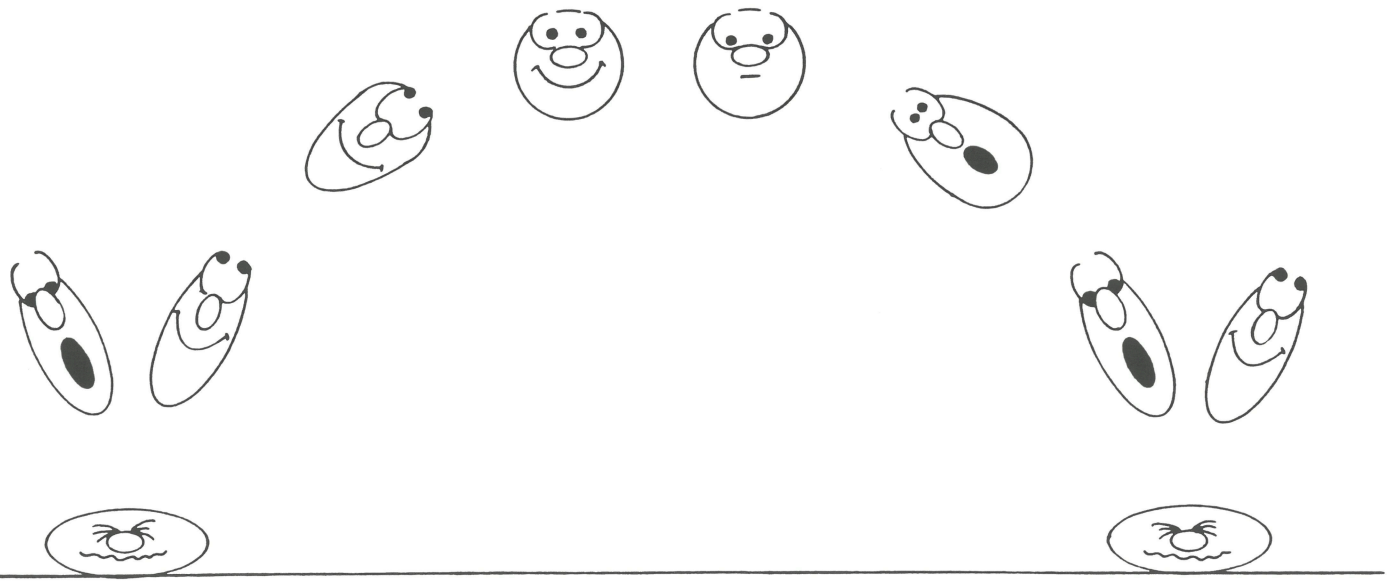
Silver Burdett & Ginn

Grade	Chapter	Pages	Processes	Topic
K	1	18-23	Observing Comparing	Seeing and hearing.
K	7	70-76		Energy.
K	7	72	Observing Comparing	Ways in which things move.
K	7	74	Observing Comparing	Directions in which things move.
1	6	96-109	Observing	Moving things.
2	4	62-79	Observing	Using senses to learn about things.
2	4	66-67	Observing	Matter takes up space.
2	4	68-71	Observing	Matter has weight.
2	4	76	Observing Comparing	Matter can be grouped by weight.
3	5	86-99	Observing	The properties of matter.
3	6	104-119	Observing	Force, work, and energy.
4	5	93-98	Observing	Measuring length.
4	6	113-125	Observing Comparing	Forms of energy.

TEXTBOOK CORRELATION (continued)

Merrill

Grade	Chapter	Pages	Processes	Topic
K	1	4-14	Observing	Using senses to learn about things.
1	1	2-21	Observing	You find out. Using senses to learn about things.
1	7	134-149	Observing Comparing Inferring	Push or pull. You can move things. Objects can move up and down. Machines can help us move things.
2	4	74-85	Observing	You can measure.
3	3	44-53	Observing	Properties of matter.
3	7	120-128	Observing	Forces, work, and energy.
5	12	220-234	Observing	Motion and forces.
5	16	304-321	Comparing	Forms of energy.
Activity	16	310	Comparing	Kinetic and potential energy.



TEXTBOOK CORRELATION (continued)

Holt

Grade	Chapter	Pages	Processes	Topic
K	2	9-15	Observing Comparing	Seeing and hearing. Using senses to learn about things.
K	4	25-31	Comparing	Comparing objects.
K	4	31		Position.
1	1	3-11	Observing	Use of your senses. Using senses to learn about things.
1	5	75-83	Observing	Position.
2	4	143-159	Observing Comparing Inferring	Force. Force is used to move objects. Force is a push or a pull. The amount of force used can vary. A strong force is needed to move heavy things. A weak force is needed to move light things.
2	8	165-177	Observing	Moving.
2	8	165-177	Observing Comparing	Moving things rub against other things. Friction can slow the movement of objects.
2	8	167	Observing	A ball rubs against air. The air slows it down.
4	11	206-209	Observing	What is work?
Activity	11	209	Observing	How can force be measured?
6	1	12-29	Observing	Measuring motion.
6	2	39-46		Gravity and friction.
6	3	57-72	Observing	Energy.
Activity	3	63	Observing Comparing	What changes the amount of kinetic energy in an object?

TEXTBOOK CORRELATION (continued)

Addison Wesley

Grade	Chapter	Pages	Processes	Topic
1	Intro	6-11	Observing	What is science?
1	8	78-83	Comparing	Comparing.
1	8	79	Comparing	Making a graph.
1	8	84	Observing	Finding out.
1	9	86-91	Comparing	Measuring.
1	9	87	Comparing	Making a measuring tape.
1	9	92	Observing	Finding out.
1	10	94-99	Observing	Making things move.
1	10	95	Observing	Moving a ball.
1	10	100	Observing	Finding out.
2	8	88	Observing	Matter.
2	8	89	Observing Comparing	Learning that things take up space.
2	8	90	Observing	Volume.
2	8	91	Observing	Mass.
3	5	110-121	Comparing	Properties of matter.
3	6	132-141	Comparing	Types of forces and work.
3	7	158-175	Observing	Energy.
4	5	108-122	Observing Comparing	Characteristics of matter.
4	8	176-181	Observing	Why things move.
5	8	184-200	Observing	Motion.
6	7	158-169	Observing	Understanding energy.
Activity	7	169	Observing Comparing Inferring	How does the height from which a ball is dropped affect its bounce?

1

What I Found Out

Name _____

The ball was dropped from a height of _____units.

The ball was dropped on a _____floor.

Type of Ball	Number of Bounces	First Bounce
Croquet Ball	_____	_____
Cannon Ball	_____	_____
Gum Ball	_____	_____
Baseball	_____	_____
Tennis Ball	_____	_____
Ping-Pong Ball	_____	_____
Bowling Ball	_____	_____
Jacks Ball	_____	_____
Golf Ball	_____	_____
Beach Ball	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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2

What I Found Out—
Hard Floor I

Name _____

Type of Ball _____

Height Dropped	Number of Bounces	First Bounce
1 unit	_____	_____
2 units	_____	_____
3 units	_____	_____
4 units	_____	_____
5 units	_____	_____
6 units	_____	_____
7 units	_____	_____
8 units	_____	_____
9 units	_____	_____
10 units	_____	_____

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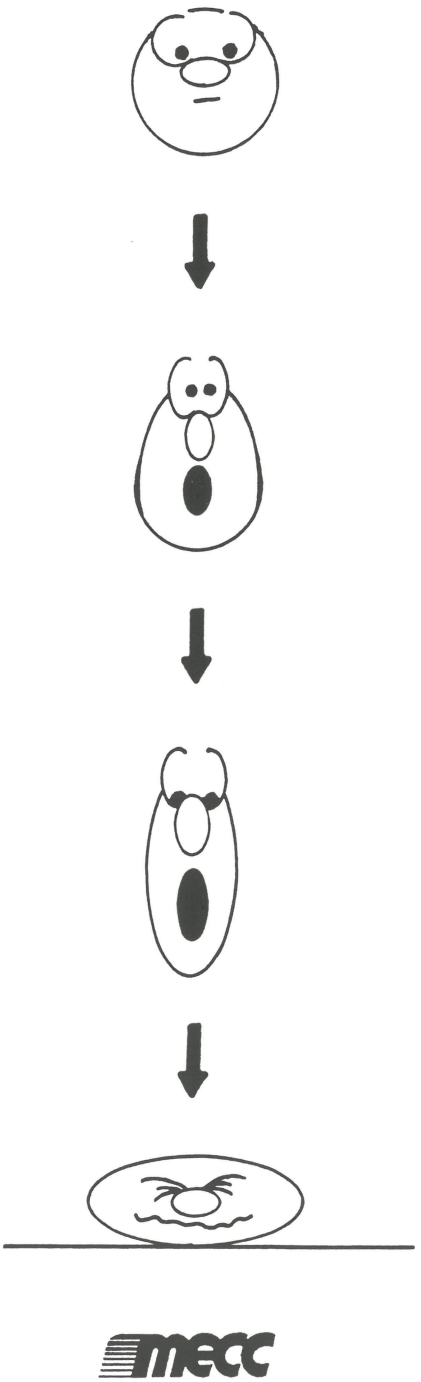
3

What I Found Out—
Hard Floor II

Name _____

Type of Ball _____

Height Dropped	Number of Bounces
1 unit	_____
2 units	_____
3 units	_____
4 units	_____
5 units	_____
6 units	_____
7 units	_____
8 units	_____
9 units	_____
10 units	_____



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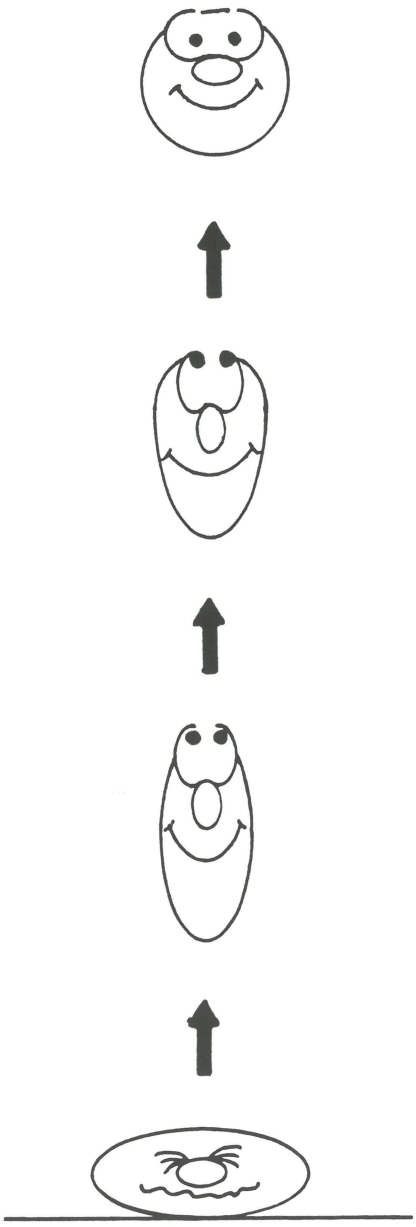
4

What I Found Out—
Hard Floor III

Name _____

Type of Ball _____

Height Dropped	First-Bounce Height
1 unit	_____
2 units	_____
3 units	_____
4 units	_____
5 units	_____
6 units	_____
7 units	_____
8 units	_____
9 units	_____
10 units	_____



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5

What I Found Out—
Soft Floor I

Name _____

Type of Ball _____

Height Dropped	Number of Bounces	First Bounce
1 unit	_____	_____
2 units	_____	_____
3 units	_____	_____
4 units	_____	_____
5 units	_____	_____
6 units	_____	_____
7 units	_____	_____
8 units	_____	_____
9 units	_____	_____
10 units	_____	_____

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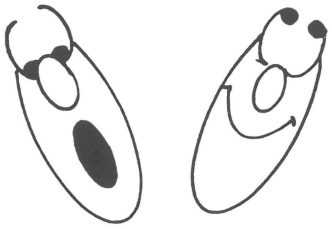
6

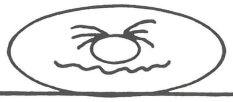
What I Found Out—
Soft Floor II

Name _____

Type of Ball _____

Height Dropped	Number of Bounces
1 unit	_____
2 units	_____
3 units	_____
4 units	_____
5 units	_____
6 units	_____
7 units	_____
8 units	_____
9 units	_____
10 units	_____





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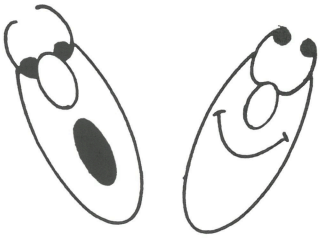
7

What I Found Out—
Soft Floor III

Name _____

Type of Ball _____

Height Dropped	First-Bounce Height
1 unit	_____
2 units	_____
3 units	_____
4 units	_____
5 units	_____
6 units	_____
7 units	_____
8 units	_____
9 units	_____
10 units	_____



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8

What I Found Out—
Bouncing Data

Name _____

I used BLOCKS RULER (circle one)

Variables			Results	
Type of Ball	Type of Floor	Height Dropped	Height Bounced	Number of Bounces
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

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What I Found Out—
Bouncing Conclusions

9

Name _____

Based on your ***Woolly Bounce*** experiments, answer the following questions:

1. Name the ball that bounced the highest. Highest : _____

2. Name the ball that bounced the lowest. Lowest: _____

3. Name the ball that bounced the most. Most: _____

4. Name the ball that bounced the least. Least: _____

5. Woolly dropped a big black ball from block five (5).
   The big black ball bounced seven (7) times.
   Woolly dropped the big black ball from block ten (10).

   - Did the big black ball bounce <u>more</u> than seven (7) times or <u>less</u> than seven (7) times?

     _____

   - Why did the big black ball bounce a different number of times?

     _____

4. Woolly dropped a small red ball on a soft floor.
   The small red ball bounced six (6) times.
   Woolly dropped the small red ball on a hard floor.

   - Did the small red ball bounce <u>more</u> than six (6) times or <u>less</u> than six (6) times?

     _____

   - Why did the small red ball bounce a different number of times?

_____

5. Woolly dropped a green ball twelve (12) units.
   The ball bounced up eight (8) units on the first bounce.

   - Did it bounce <u>more</u> than eight (8) units or
     did it bounce <u>less</u> than eight (8) units on the second bounce?

     _____

   - Why did the ball bounce up to a different height on the second bounce?

_____

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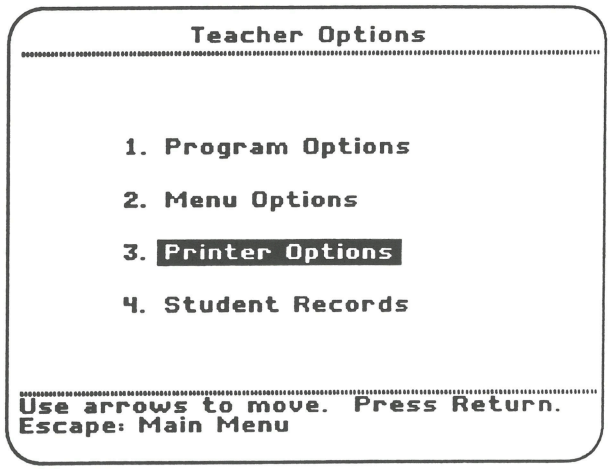
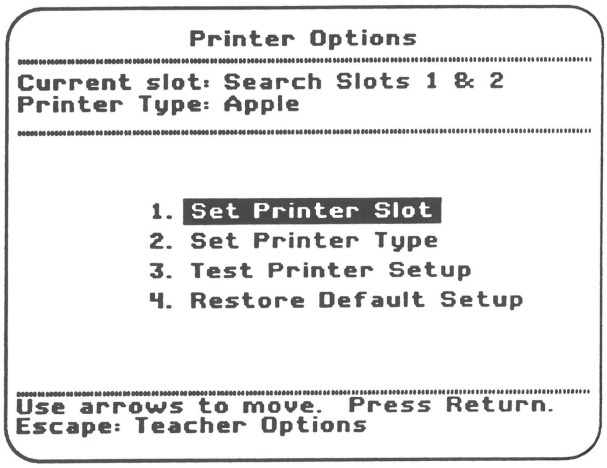
USING A PRINTER WITH THIS COURSEWARE

This product is initially set to work with a standard Apple printer card located in either Slot 1 or Slot 2. If you have this setup, you do not need to do anything further. If your printer uses another setup, or if you want to select or use special commands, use Printer Options.

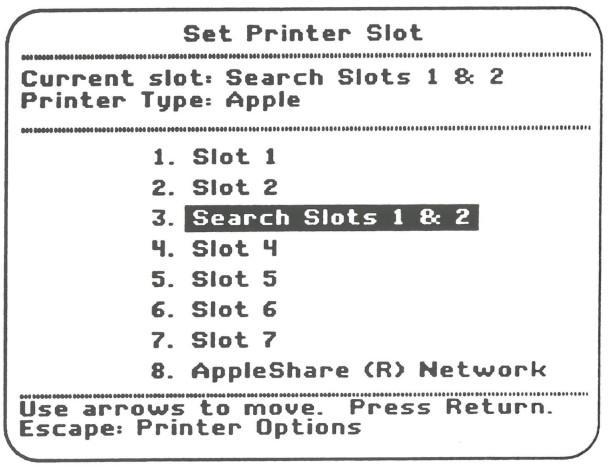
Printer Options appears on the ***Woolly Bounce*** Teacher Options menu. You may access the Teacher Options from the main menu by typing Control-A.



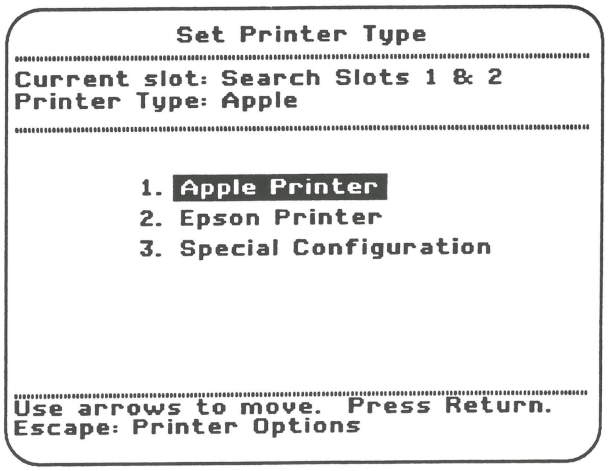
From the ***Woolly Bounce*** Teacher Options menu, selecting Option 3 takes you to the Printer Options menu. The current printer settings are shown at the top of the screen.


Printer Options
Current slot: Search Slots 1 & 2
Printer Type: Apple
1. Set Printer Slot
2. Set Printer Type
3. Test Printer Setup
4. Restore Default Setup
Use arrows to move. Press Return.
Escape: Teacher Options

Option 1, Set Printer Slot, allows you to specify the slot in which your printer interface card is located. If you are using an AppleShare® Network, choose option 8. This setting will automatically select the correct printer slot for each computer on the network.



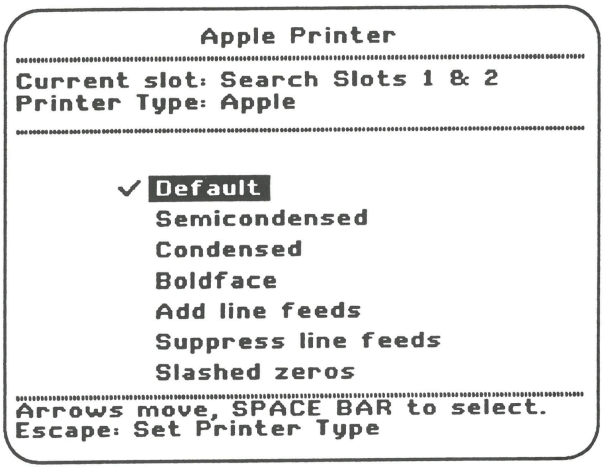
Option 2, Set Printer Type, allows you to select the type of printer you are using: either an Apple, an Epson, or a special configuration.



Selecting **Apple Printer** allows you to choose one or more of the options shown in this screen.

You are not able to select both semi-condensed and condensed, or add line feeds and suppress line feeds, at the same time.

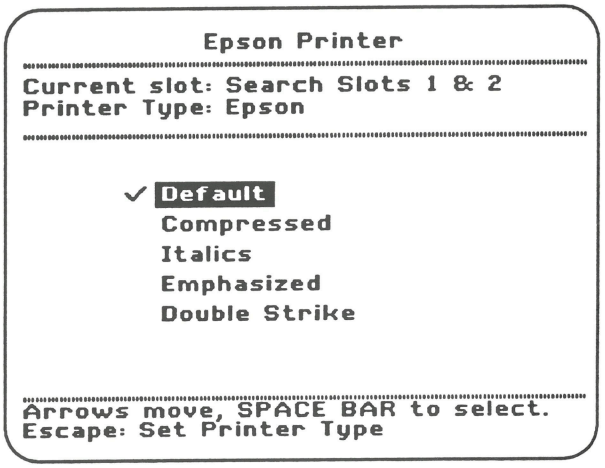
Selecting Default clears from the *program* all other customized options or special commands. To ensure that the *printer* clears all previous commands, turn the printer off, wait several seconds, and then turn it back on again before printing.



Selecting **Epson Printer** allows you to choose one or more of the options shown in this screen.

You are not able to select both emphasized and compressed at the same time.

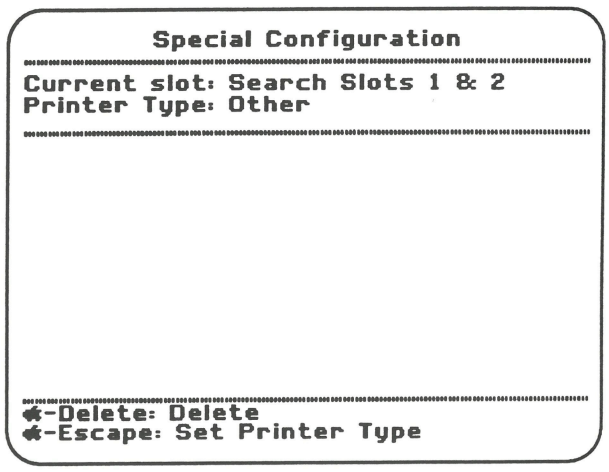
Selecting Default clears from the *program* all other customized options or special commands. To ensure that the *printer* clears all previous commands, turn the printer off, wait several seconds, and then turn it back on again before printing.



Selecting **Special Configuration** allows you to enter commands that enable certain types of printers to operate. These special commands are listed in the manufacturer's printer manual.

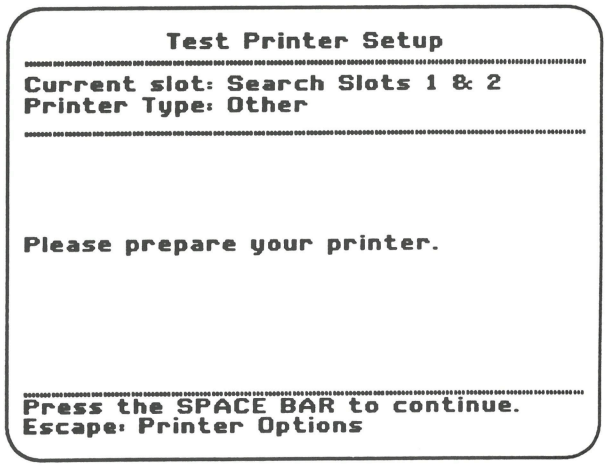
To enter special commands, type the exact characters required. When finished, type ⌘-Escape to end.

Do not set up the printer to use a proportional font. This setting will cause printed student records to be formatted incorrectly.

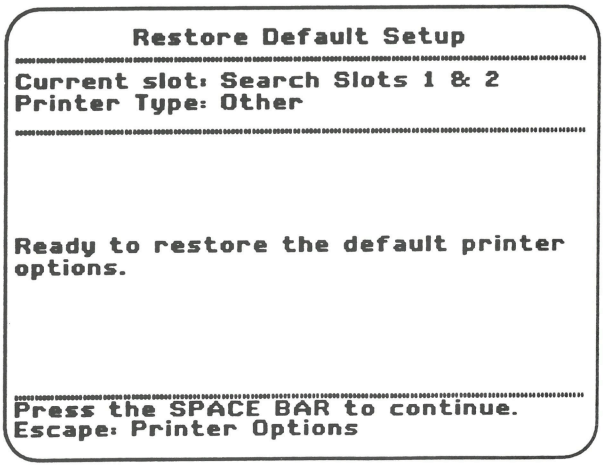


Option 3, Test Printer Setup, prints out all of the keyboard characters. If these characters are not printed correctly, check the settings on your printer or interface card, check to see whether your printer has been connected correctly, or look at your interface card manual for special commands.

Note: To ensure that previous printer commands are cleared, turn the printer off, wait several seconds, and then turn it back on again before performing this test.


Test Printer Setup
Current slot: Search Slots 1 & 2
Printer Type: Other
Please prepare your printer.
Press the SPACE BAR to continue.
Escape: Printer Options

Option 4, Restore Default Setup, returns all printer settings to their original state. The original printer setup provides a search of Slots 1 and 2 for a default Apple printer.


Restore Default Setup
Current slot: Search Slots 1 & 2
Printer Type: Other
Ready to restore the default printer options.
Press the SPACE BAR to continue.
Escape: Printer Options

All changes made to the Printer Options settings are saved on the disk and are permanent until you use the Printer Options again to change the printer settings.

CREDITS

Woolly Bounce was produced by a MECC development team that included Gene Breault, Kim D. Smith, Scott Jensen, Charolyn Kapplinger, and the *Science Inquiry Collection* team.

MECC extends a special thanks to the following teachers and their students for their assistance in developing this product:

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Molly Mueller, and
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Patricia Curtin,
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Sara Vegge,
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Fridley, Minnesota

TO THE READER:

MECC has made every effort to ensure the instructional quality of this courseware package. Your comments—as user or reviewer—are valued and will be considered for inclusion in any future revision of the product. Please address your comments to:

MECC Software Development
6160 Summit Drive North
Minneapolis, Minnesota 55430-4003

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Yager, Robert E. and John E. Penick. "Creativity and Science Learning." *Science Scope* (January 1990): 15.

Young, Sharon L. "IDEAS." *Arithmetic Teacher* (November 1990): 23-32. (Excellent set of basic math-oriented, ball-bouncing-activity ideas and worksheets.)

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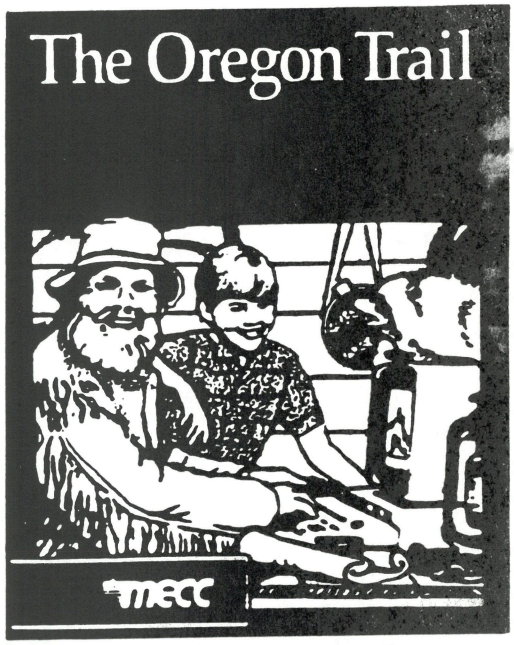

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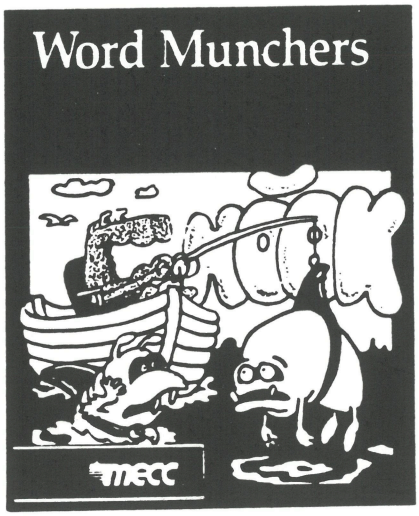

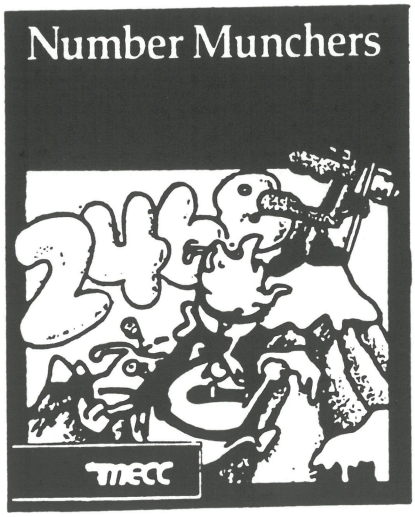

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Q. *I've read the license agreement for one of the software packages purchased by our school. What if I'm not sure that I understand the arrangement correctly?*

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